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ATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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INTRODUCTION

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STAR is a comprehensive abstracting and indexing journal covering current worldwide *report* literature on the science and technology of space and aeronautics. Publications abstracted in *STAR* include scientific and technical reports issued by NASA and its contractors, other U.S. Government agencies, corporations, universities, and research organizations throughout the world. Pertinent theses, translations, NASA-owned patents and patent applications, and other separate documents are also abstracted. Citations and abstracts in *STAR* are grouped in 34 subject categories, although accession numbers run in unbroken sequence through the *STAR* issues, without regard to category assignment.

Certain publications abstracted in *STAR* are given analytic treatment, with citations and abstracts of daughter items following immediately after the parent document. When the subject content of a daughter differs from that of its parent, a cross-reference citation is printed at the end of the category to which the daughter would normally have been assigned.

Five indexes are included in each issue: subject, personal author, corporate source, contract number, and report/accession number. Cumulative index volumes are published semiannually and annually.

STAR, issued on the 8th and 23rd of each month, is available to the public on subscription from the Superintendent of Documents, U.S. Government Printing Office, as noted on the inside cover. *STAR* is sent without charge to qualified organizations registered with NASA as described in the paragraph *Eligibility and Registration for NASA Information Products and Services*.

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Cumulated index volumes: United States and possessions, $75 postpaid; foreign countries, $90 postpaid.

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The Preliminary Edition of the *NASA Thesaurus* (December 1967) (NASA SP-7030) is used as the authority for the indexing vocabulary that appears in the subject index. The *NASA Thesaurus* should be consulted in examining the current indexing vocabulary, including associated cross-reference structure. Only the subject terms that have been selected to describe the documents abstracted in this issue appear in the subject index. Copies of the *NASA Thesaurus* may be obtained from the National Technical Information Service or the U.S. Government Printing Office at $8.50 for the three-volume set. The first two volumes of this Thesaurus, consisting of the alphabetical listing of subject terms (A–Z), have been superseded by the following single-volume publication: *NASA Thesaurus Alphabetical Update* (September 1971) (NASA SP-7040), available from NTIS for $6.00. (Volume III of the Preliminary Edition consists of the following ancillary aids to vocabulary selection: hierarchical display of index terms, category term listing, permuted index, and a listing of postable terms only.)

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02 Aircraft 2
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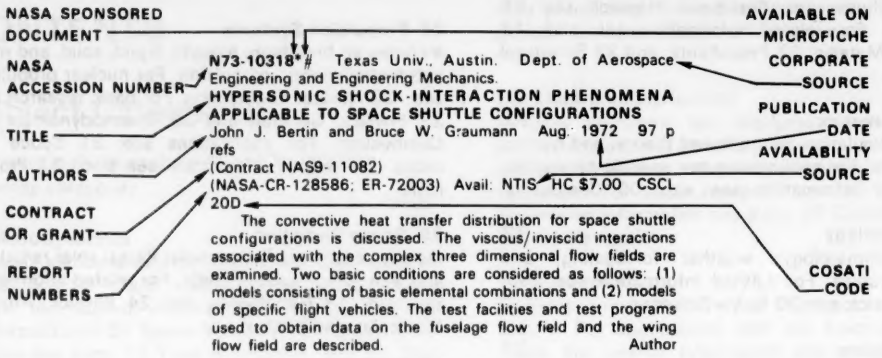
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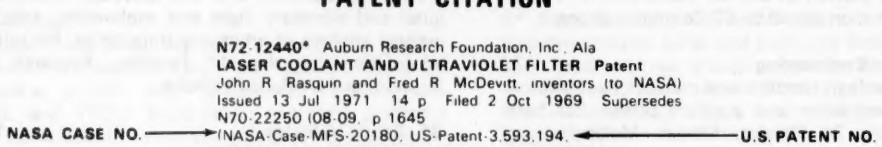
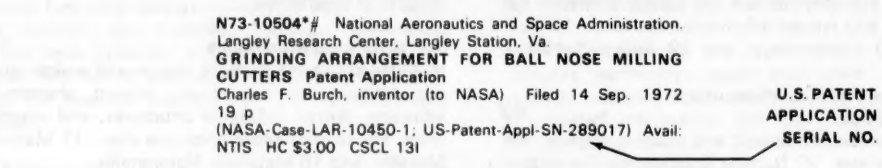
HYPERSONIC SHOCK-INTERACTION PHENOMENA APPLICABLE TO SPACE SHUTTLE CONFIGURATIONS
John J. Bertin and Bruce W. Graumann Aug. 1972 97 p refs
(Contract NAS9-11082)
(NASA-CR-128586; ER-72003) Avail: NTIS HC $7.00 CSCL 20D
The convective heat transfer distribution for space shuttle configurations is discussed. The viscous/inviscid interactions associated with the complex three dimensional flow fields are examined. Two basic conditions are considered as follows: (1) models consisting of basic elemental combinations and (2) models of specific flight vehicles. The test facilities and test programs used to obtain data on the fuselage flow field and the wing flow field are described. Author

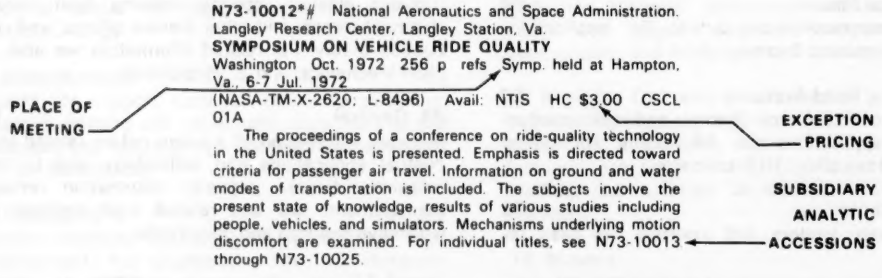
PATENT CITATION


NASA CASE NO.
U.S. PATENT CLASS NUMBERS
U.S. PATENT NO.
N72-12440* Auburn Research Foundation, Inc., Ala
LASER COOLANT AND ULTRAVIOLET FILTER Patent
John R. Rasquin and Fred R. McDevitt, inventors (to NASA)
Issued 13 Jul 1971 14 p Filed 2 Oct 1969 Supersedes N70-22250 (08-09, p 1645
(NASA-Case-MFS-20180; US-Patent-3,593,194; US-Patent-Appl-SN-863276; US-Patent-Class-331-94.5; US-Patent-Class-350-1; US-Patent-Class-350-312) Avail: US Patent Office CSCL 20E

PATENT APPLICATION CITATION


U.S. PATENT APPLICATION SERIAL NO.
N73-10504*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GRINDING ARRANGEMENT FOR BALL NOSE MILLING CUTTERS Patent Application
Charles F. Burch, inventor (to NASA) Filed 14 Sep. 1972 19 p
(NASA-Case-LAR-10450-1; US-Patent-Appl-SN-289017) Avail: NTIS HC $3.00 CSCL 13I

PRIMARY ANALYTIC CITATION AND ABSTRACT


PLACE OF MEETING
EXCEPTION PRICING
SUBSIDIARY ANALYTIC ACCESSIONS
N73-10012*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SYMPOSIUM ON VEHICLE RIDE QUALITY
Washington Oct. 1972 256 p refs Symp. held at Hampton, Va., 6-7 Jul. 1972
(NASA-TM-X-2620; L-8496) Avail: NTIS HC $3.00 CSCL 01A
The proceedings of a conference on ride-quality technology in the United States is presented. Emphasis is directed toward criteria for passenger air travel. Information on ground and water modes of transportation is included. The subjects involve the present state of knowledge, results of various studies including people, vehicles, and simulators. Mechanisms underlying motion discomfort are examined. For individual titles, see N73-10013 through N73-10025.

SUBSIDIARY ANALYTIC CITATION

PRIMARY ANALYTIC ACCESSION AND LOCATION OF FULL CITATION AND ABSTRACT
PAGES IN PRIMARY REPORT
N73-10014* Douglas Aircraft Co., Inc., Long Beach, Calif.
AN AIRCRAFT MANUFACTURER'S APPROACH TO RIDEABILITY CRITERIA
R. C. OMassey, H. Leve, and J. G. Gaume In NASA. Langley Res. Center Symp. on Vehicle Ride Quality Oct. 1972 p 23-49 refs (For availability see N73-10012 01-02)
CSCL 01A

VOLUME 11 NUMBER 1 / JANUARY 8, 1973

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N73-10001# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.

WIND TUNNEL INVESTIGATION OF SIMULATED HOAR FROST ON A 2 DIMENSIONAL WING SECTION WITH AND WITHOUT HIGH LIFT DEVICES

Bjoern L. G. Ljungstroem Apr. 1972 32 p refs

(FFA-AU-902) Avail: NTIS HC $3.75

The effect of simulated hoar frost on the lift and drag characteristics of a two-dimensional wing section with and without high lift devices was investigated in a wind tunnel. Three wing configurations were tested. Three different grain size grinding papers were used to simulate hoar frost. The roughness was partly removed from the leading edge to simulate partial cleaning of the frost from the aircraft wing. It was determined that the maximum lift coefficient is very sensitive to distributed roughness for all three configurations. Author

N73-10002*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AERODYNAMIC CHARACTERISTIC OF A SWEPT-WING CRUISE MISSILE AT MACH NUMBERS FROM 0.50 TO 2.86

M. Leroy Spearman and Ida K. Collins Washington Nov. 1972 41 p

(NASA-TN-D-7069; L-8508) Avail: NTIS HC $3.00 CSCL 01A

An investigation has been made in the Mach number range from 0.50 to 2.86 to determine the longitudinal and lateral aerodynamic characteristics of a cruise missile having a 58 deg swept wing and conventional aft tails. Such a vehicle might be applicable to missions such as surface- or air-launched tactical or strategic missiles, unmanned reconnaissance, or countermeasure decoys. Author

N73-10003*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FLOW CONDITIONS AROUND THE EXIT AND DOWNSTREAM OF CERTAIN STATOR BLADING WITH VARIOUS TRAILING EDGE THICKNESSES AND GEOMETRIES

Herman W. Prust, Jr. and Ronald M. Helon Washington Oct. 1972 45 p refs

(NASA-TM-X-2659; E-7024) Avail: NTIS HC $3.00 CSCL 20D

The blading investigated was curved back with thick profiles. The variations in flow conditions considered were flow angle and isentropic energy. Experimental data were obtained in a two-dimensional cascade from surveys with a combined angle, total-, and static-pressure probe and from an array of end-wall static pressure taps. Analytical results were obtained from ideal flow theory. The results showed large variations in flow conditions close to the plane of the trailing edge that were largely attenuated at a distance a little greater than one blade pitch downstream of the trailing edge in the direction of flow. The results were affected by the geometry and thickness of the trailing edge. The agreement between experimental and analytical results is generally fair to excellent. Author

N73-10004+ Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.

FORCE MEASUREMENTS ON CARET AND DELTA WINGS AT HIGH INCIDENCE

G. T. Colemann Jul. 1972 28 p refs

(IC-Aero-72-16) Avail: NTIS HC $3.50

Comparative measurements were made on flat delta and caret wing models under high lift reentry conditions and compared with theoretical predictions for the normal force coefficient. Tests were carried out in the Imperial College No.2 gun tunnel at Mach 9 with nitrogen as the test gas. The distinct advantage of the caret wing over the incidence range was shown and good agreement was found between the data and Squire's theoretical curve for the caret wing. Author (ESRO)

N73-10005# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.

CALCULATIONS OF THE STEADY CONICAL FLOW PAST A YAWED SLENDER DELTA WING WITH LEADING EDGE SEPARATION

D. I. Pullin Jul. 1972 73 p refs Sponsored by Sydney Univ.

(IC-Aero-72-17) Avail: NTIS HC $5.75

The Mangler and Smith vortex-sheet model of leading-edge separation is extended to the calculation of steady conical flow past a yawed slender delta wing. A Newton-Raphson iterative procedure is then used to solve the resulting set of nonlinear algebraic equations for a range of values of the incidence and yaw parameters. From the solutions, predictions are obtained for the positions of the vortex core centers and the leeward and windward separation systems; for the wing surface pressure distribution and the normal-force and rolling moment coefficient. Comparison of the variation of these quantities with incidence and yaw parameters with experimental data is fair, differences being attributed to the neglect of the secondary separation of the windward side of the wing. At lower value of the incidence parameter the Newton-Raphson procedure failed to yield solutions of the equations. Author (ESRO)

N73-10006# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Theoretische Aerodynamik.

EXPERIMENTAL INVESTIGATIONS OF THE LINEAR AND NONLINEAR PARTS OF THE AERODYNAMIC COEFFICIENTS OF A SLENDER BODY IN SUPERSONIC FLOW [EXPERIMENTELLE UNTERSUCHUNGEN UEBER DIE LINEAREN UND NICHTLINEAREN ANTEILE DER AERODYNAMISCHEN BEIWERTE EINES SCHLANKEN RUMPFES BEI UEBERSCHALLANSTROEMUNG]

Hans Koester Jun. 1972 59 p refs In GERMAN; ENGLISH

summary
(DLR-FB-72-42) Avail: NTIS HC $5.00; DFVLR, Porz 14,50 DM

An analysis is given of the aerodynamic coefficients of a slender body of revolution, the cross section distribution of which is optimized for minimum wave drag at zero incidence. The tests were carried out in a supersonic wind tunnel in the Mach number range 1.5 to 4. The results presented show the influence of incidence on the pressure distribution. The comparison of the results between force and pressure measurements shows good agreement for the linear contributions of the lift and pitching moment, whereas their nonlinear contributions and the values of the drag partly differ from each other. Author (ESRO)

N73-10007# Yale Univ., New Haven, Conn. Becton Center.
IDENTIFICATION AND OPTIMIZATION OF AIRCRAFT DYNAMICS
Kumpati S. Narendra and Shiva S. Tripathi Jul. 1972 30 p refs
(Contract N00014-67-A-0097-0020; NR Proj. 375-131)
(AD-746492; CT-50) Avail: NTIS CSCL 01/3

A technique is described for the design of an adaptive controller for multivariable systems and is based on recently developed methods for identification and optimization. An application of the method to a helicopter system with time-varying parameters is considered in detail. The response of the adaptive system is compared with the corresponding response of a system with a fixed controller and a system using optimal control. The comparison reveals the almost optimal character of the adaptive system. Author (GRA)

N73-10008# West Virginia Univ., Morgantown. Dept. of Aerospace Engineering.
CALCULATION OF THE LIFT ON AIRFOILS WITH SEPARATED BOUNDARY LAYERS
Nathan Ness, Edward H. Gibbs, and Wen-An Peter Tseng May 1972 108 p
(Contract N00014-68-A-0512; NR Proj. 215-163)
(AD-746505; TR-31) Avail: NTIS CSCL 20/4

The report contains a method for calculating the sectional lift coefficient Cl as a function of its angle of attack alpha and free stream Reynolds number Re even at large angles of attack beyond the maximum Cl. The results of the present theory are in agreement with all known experimental data, that is, (1) the theory shows that Cl increases with alpha until stall and then decreases as alpha is increased still further (keeping Re constant), (2) the theory shows that the Reynolds number effect on Cl versus alpha is insignificant at the lower angles of attack but becomes more pronounced near and beyond the stall where viscous effects and flow separation are more important, (3) the theory shows that Cl increases with Re at constant (high) values of alpha. Author (GRA)

02 AIRCRAFT

Includes fixed-wing airplanes, helocopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N73-10009 Engineering Sciences Data Unit, London (England).
TITLES, 1972
1972 28 p refs
Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

The titles of all Data Items issued by ESDU to the end of 1971 are listed with their date of issue and latest amendment. Items in aerodynamics, fatigue, performance, structures, and transonic aerodynamics are included. F.O.S.

N73-10010# Technische Hogeschool, Delft (Netherlands).
ANALYSIS OF DYNAMIC AIRCRAFT LANDING LOADS, AND A PROPOSAL FOR RATIONAL DESIGN LANDING LOAD REQUIREMENTS Ph.D. Thesis
Jacob Ijff 27 Jun. 1972 175 p refs
Avail: NTIS HC $10.75

The formulation of requirements for safety is investigated in designing the main landing gears to withstand design loads due to landing impacts. The physical phenomena involved in a landing impact are described along with the existing design requirements. A survey of literature, the equations for calculating wing loads, and the influence of aerodynamic variables on landing impact loads are discussed. A summary of the results is included. F.O.S.

N73-10011*# Systems Control, Inc., Palo Alto, Calif.
ANALYSIS OF INSTRUMENTATION ERROR EFFECTS ON THE IDENTIFICATION ACCURACY OF AIRCRAFT PARAMETERS Final Technical Report
John A. Sorensen May 1972 105 p refs
(Contract NAS1-10791)
(NASA-CR-112121) Avail: NTIS HC $7.25 CSCL 01B

An analytical investigation is reported of the effect of unmodeled measurement system errors on the accuracy of aircraft stability and control derivatives identified from flight test data. Such error sources include biases, scale factor errors, instrument position errors, misalignments, and instrument dynamics. Output error identification algorithms that tend to minimize quadratic functions of the difference between actual and modeled aircraft trajectory measurements are studied. Two techniques, ensemble analysis and simulated data analysis, are formulated to determine the quantitative variations to the identified parameters resulting from the unmodeled instrumentation errors. The parameter accuracy that would result from flight tests of the F-4C aircraft with typical quality instrumentation is determined using these techniques. Author

N73-10012*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SYMPOSIUM ON VEHICLE RIDE QUALITY
Washington Oct. 1972 256 p refs Symp. held at Hampton, Va., 6-7 Jul. 1972
(NASA-TM-X-2620; L-8496) Avail: NTIS HC $3.00 CSCL 01A

The proceedings of a conference on ride-quality technology in the United States is presented. Emphasis is directed toward criteria for passenger air travel. Information on ground and water modes of transportation is included. The subjects involve the present state of knowledge, results of various studies including people, vehicles, and simulators. Mechanisms underlying motion discomfort are examined. For individual titles, see N73-10013 through N73-10025.

N73-10013* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RIDE QUALITY OVERVIEW
Ralph W. Stone, Jr. *In its* Symp. on Vehicle Ride Quality Oct. 1972 p 1-22 refs (For availability see N73-10012 01-02) CSCL 01A

An analysis of the factors which affect riding comfort in various modes of transportation is presented. The subjects discussed are: (1) human factor elements in ride quality, (2) current knowledge of flight dynamics and relation to passenger acceptance, (3) study requirements for human factors in ride quality, and (4) possible criteria for human factor in ride quality. Author

N73-10014* Douglas Aircraft Co., Inc., Long Beach, Calif.
AN AIRCRAFT MANUFACTURER'S APPROACH TO RIDEABILITY CRITERIA
R. C. OMassey, H. Leve, and J. G. Gaume *In* NASA. Langley Res. Center Symp. on Vehicle Ride Quality Oct. 1972 p 23-49 refs (For availability see N73-10012 01-02)
CSCL 01A

The approach of an aircraft manufacturer to ride quality in air transportation is presented. The subjects discussed are: (1) the external and internal environment in terms of vibration and acoustic sources and general response, (2) guidelines and criteria reflecting current practice, (3) present and future efforts to

develop rideability criteria, and (4) requirements for data, criteria, and research in various rideability areas. Author

N73-10015* United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
RIDE QUALITY CRITERIA FOR LARGE COMMERCIAL HELICOPTERS
Ronald G. Schlegel, Allen M. Stave, and Alfred A. Wolf *In* NASA. Langley Res. Center Symp. on Vehicle Ride Quality Oct. 1972 p 51-66 refs (For availability see N73-10012 01-02)
CSCL 01A

A review of major ride-quality criteria used in the design of commercial helicopters, some of the limitations of these criteria, research programs conducted to better define these criteria, and some recommended research programs is presented. Primary emphasis is given to the question of noise and vibration criteria for passenger acceptance and comfort. Author

N73-10016* Princeton Univ., N.J.
EXPLORATORY FLIGHT INVESTIGATION OF RIDE QUALITY IN SIMULATED STOL ENVIRONMENT
Edward Seckel and George E. Miller *In* NASA. Langley Res. Center Symp. on Vehicle Ride Quality Oct. 1972 p 67-89 (For availability see N73-10012 01-02)
CSCL 01A

A flight test experiment is described, in which various aspects of ride qualities were explored. Situations included simulated cruise and terminal area maneuvers, as might be typical of STOL transport operations. Various motion components were studied in isolation and in many combinations. The experiment included runs with and without turbulence, variations in airplane stability and handling qualities, and differences of pilot technique. The ride quality was strongly affected by roll, yaw, and heave motions; but very little by pitching. It was strongly affected by airplane stability and handling qualities and, in some cases, by piloting technique. Author

N73-10017* Boeing Co., Wichita, Kans.
TESTS AND ANALYSES APPLICABLE TO PASSENGER RIDE QUALITY OF LARGE TRANSPORT AIRCRAFT
Richard B. Holloway and Stanley H. Brumaghin *In* NASA. Langley Res. Center Symp. on Vehicle Ride Quality Oct. 1972 p 91-113 refs (For availability see N73-10012 01-02)
CSCL 01A

A test program was undertaken to determine airline passenger reaction to vibration environments that might be encountered in a supersonic transport or other large commercial jet aircraft. The principal problem addressed was to determine accelerations of vertical and lateral vibration that people find objectionable. Further questions experimentally posed were: (1) what is the relationship between human reactions to vertical and lateral vibration, (2) to single- and combined-frequency vibration, and (3) to single- and combined-axis vibration? Interest was confined to reactions to vibration in the frequency range of 0.20 to 7.0 Hz, a range typical of the vibration environment of a large airplane. Results indicated an increasing sensitivity to vertical vibration as frequency was increased from 1.0 to 7.0 Hz. Subjects were found most sensitive to lateral vibration in the 1.0 to 3.0 Hz range. There was a nearly linear decrease in sensitivity as frequency of lateral vibration was increased from 3.0 to 7.0 Hz. Author

N73-10018* United Aircraft Corp., East Hartford, Conn. Research Labs.
ANALYTICAL AND EXPERIMENTAL EVALUATION OF PROPOSED RIDE COMFORT CRITERIA c11
E. Wayne Vinje *In* NASA. Langley Res. Center Symp. on Vehicle Ride Quality Oct. 1972 p 115-141 (For availability see N73-10012 01-02)
CSCL 01A

An exploratory study was conducted to evaluate the effectiveness of indices proposed by different investigators to relate vehicle vibrations to passenger comfort. The indices considered included criteria for sinusoidal vibrations, unweighted and weighted amplitude exceedance counts, the integral of the unweighted and weighted power spectral density and absorbed power. These functions were initially examined analytically to determine the manner in which they each weighed vibration amplitude and frequency. Similarities among them are noted. Index values were then computed from measured vibrations and compared with the associated comfort ratings. The data for these comparisons were obtained from ride comfort evaluations of passenger trains. Author

N73-10019* Boeing Co., Philadelphia, Pa. Vertol Div.
HELICOPTER CREW/PASSENGER VIBRATION SENSITIVITY
Richard Gabel and Donald A. Reed *In* NASA. Langley Res. Center Symp. on Vehicle Ride Quality Oct. 1972 p 143-153 ref (For availability see N73-10012 01-02)
CSCL 06S

Helicopter crew and passenger vibration sensitivity are presented. Pilot subjective ratings are established for discrete frequencies and the impact of combinations of harmonic frequencies is examined. A passenger long term comfort level and a short term limit are defined for discrete frequencies and compared with pilot ratings. The results show reasonable agreement between pilot and passenger. Subjective comfort levels obtained for mixed frequency environments clearly demonstrate the need for a multi-frequency criterion. Author

N73-10020* Naval Aerospace Medical Research Lab., Pensacola, Fla.
SOME OF THE MECHANISMS UNDERLYING MOTION SICKNESS c04
Ashton Graybiel *In* NASA. Langley Res. Center Symp. on Vehicle Ride Quality Oct. 1972 p 155-174 refs (For availability see N73-10012 01-02)
(NASA Order W-13433)
CSCL 06S

Some of the mechanisms contributing to the occurrence of motion sickness are discussed. It is stated that the primary factor is a loss of stability in the vestibular system caused by repetitive sensory inputs that are abnormal in terms of the central vestibular patterning encountered. Evidence is presented supporting the opinion that motion sickness is an epiphenomenon superimposed on any responses in the reflex category due to vestibular influences that cross a temporary linkage to reach nonvestibular sites where first-order motion sickness symptoms have their immediate origin. Author

N73-10021* Aerospace Research Labs., Wright-Patterson AFB, Ohio.
RIDE EVALUATION IN AEROSPACE AND SURFACE VEHICLES
A. B. Broderson, H. E. VonGierke, and J. C. Guignard (Dayton Univ., Ohio) *In* NASA. Langley Res. Center Symp. on Vehicle Ride Quality Oct. 1972 p 175-196 refs (For availability see N73-10012 01-02)
CSCL 01A

The vibration environment in a wide range of aerospace and surface vehicles is examined, and definitions related to ride evaluation are reviewed. Three provinces of research and application of ride data are recognized: (1) ride affecting passenger and operator comfort; (2) ride affecting human efficiency; and (3) ride affecting the health and safety of occupants occupationally or repeatedly exposed. Specific reference is made to the proposed ISO guide on human exposure to whole-body vibration. The applications as well as the advantages and limitations of this guide for evaluating vehicle ride are discussed. The derivation of the limits is reviewed with regard to the supporting data and the compromises necessary for wide applicability. Special discussions are included of the frequency and time dependence of these limits and approaches in progress for adjusting them according to different criteria of application. Author

N73-10022* Boeing Co., Seattle, Wash. Naval Systems Div.
MARINE VEHICLE RIDE QUALITY c11
R. J. Gornstein, W. M. Shultz, and L. D. Stair *In* NASA. Langley Res. Center Symp. on Vehicle Ride Quality Oct. 1972 p 197-209 refs (For availability see N73-10012 01-02)
CSCL 13F

The effects of marine vehicle design on passenger exposure to vibration and discomfort are discussed. The ride quality of advanced marine vehicles is examined, as a basis for marine

vehicle selection in modern water transport systems. The physiological effects of rough water on passengers are identified as requiring investigation in order to determine the acceptable limits. Author

N73-10023* Virginia Univ., Charlottesville. Center for Application of Science and Engineering to Public Affairs.
INVESTIGATION OF TRAVELER ACCEPTANCE FACTORS IN SHORT HAUL AIR CARRIER OPERATIONS c05
A. R. Kuhlthau and Ira D. Jacobson *In* NASA. Langley Res. Center Symp. on Vehicle Ride Quality Oct. 1972 p 211-228 refs (For availability see N73-10012 01-02)
CSCL 05E

The development of a mathematical model for human reaction to variables involved in transportation systems is discussed. The techniques, activities, and results related to defining certain specific inputs to the model are presented. A general schematic diagram of the problem solution is developed. The application of the model to short haul air carrier operations is examined. Author

N73-10024* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RIDE QUALITY RESEARCH ACTIVITIES AT NASA LANGLEY RESEARCH CENTER c05
Andrew B. Connor, Hugh P. Bergeron, and W. Elliott Schoonover, Jr. *In its* Symp. on Vehicle Ride Quality Oct. 1972 p 229-246 refs (For availability see N73-10012 01-02)
CSCL 05E

Ride quality research to determine criteria to describe vehicle performance characteristics which will insure passenger comfort is discussed. The manner in which disciplines of vehicle environmental dynamics, structural dynamics, and electromechanical measurements are combined to define passenger environments is described. The activities of many governmental and private agencies in the field of passenger comfort are examined. Author

N73-10025* National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
NASA RIDE QUALITY PROGRAM AT THE FLIGHT RESEARCH CENTER
Shu W. Gee and Thomas D. Wolf *In its* Symp. on Vehicle Ride Quality Oct. 1972 p 247-251 (For availability see N73-10012 01-02)
CSCL 01A

A flight test program to determine the effects of low frequency vibrations on passengers in short haul aircraft is discussed. The objective of the program is to accumulate flight test data on aircraft ride quality in terms of vehicle motion and acceleration and human responses. The subjects discussed are: (1) test procedures, (2) data processing, and (3) the program schedule. Author

N73-10026# Army Air Mobility Research and Development Lab., Fort Eustis, Va. Eustis Directorate.
EVALUATION OF THE EFFECTIVENESS OF USING SONIC DATA TO DIAGNOSE THE MECHANICAL CONDITION OF ARMY HELICOPTER POWER TRAIN COMPONENTS Final Report
G. William Hogg May 1972 102 p refs
(DA Proj. 1F1-62203-A-434)
(AD-745089; USAAMRDL-TR-72-30) Avail: NTIS CSCL 14/2

The report covers work performed during an in-house program to evaluate the effectiveness of using the sound emitted from helicopter power train components as a data source for diagnosing their mechanical condition. A ground-based UH-1 helicopter sonic analyzer developed by the Curtiss-Wright Corporation under Government contracts was used in the evaluation. Sound recordings were made on 87 UH-1 helicopters that had either the transmission or a gearbox scheduled for removal for routine overhaul. The mechanical condition of the components was then noted during the overhaul process, and then results were compared with the recorded signals in an attempt to correlate the mechanical condition with the acoustical signals. The sonic analysis procedures were then revised to improve the effectiveness of detecting component malfunctions. Author (GRA)

N73-10027*# Boeing Co., Wichita, Kans.
THE SIMULATION OF A JUMBO JET TRANSPORT AIRCRAFT. VOLUME 2: MODELING DATA
C. Rodney Hanke and Donald R. Nordwall Sep. 1970 506 p 2 Vol.
(Contract NAS2-5524)
(NASA-CR-114494; D6-30643-Vol-2) Avail: NTIS HC $27.50 CSCL 01B

The manned simulation of a large transport aircraft is described. Aircraft and systems data necessary to implement the mathematical model described in Volume I and a discussion of how these data are used in model are presented. The results of the real-time computations in the NASA Ames Research Center Flight Simulator for Advanced Aircraft are shown and compared to flight test data and to the results obtained in a training simulator known to be satisfactory. Author

N73-10028*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALYTIC PREDICTION OF AIRPLANE EQUILIBRIUM SPIN CHARACTERISTICS
William M. Adams, Jr. Washington Nov. 1972 40 p refs
(NASA-TN-D-6926; L-8319) Avail: NTIS HC $3.00 CSCL 01B

The nonlinear equations of motion are solved algebraically for conditions for which an airplane is in an equilibrium spin. Constrained minimization techniques are employed in obtaining the solution. Linear characteristics of the airplane about the equilibrium points are also presented and their significance in identifying the stability characteristics of the equilibrium points is discussed. Computer time requirements are small making the method appear potentially applicable in airplane design. Results are obtained for several configurations and are compared with other analytic-numerical methods employed in spin prediction. Correlation with experimental results is discussed for one configuration for which a rather extensive data base was available. A need is indicated for higher Reynolds number data taken under conditions which more accurately simulate a spin. Author

N73-10029*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COMPARISON OF FLIGHT AND WIND TUNNEL MEASUREMENTS OF JET NOISE FOR THE XV-5B AIRCRAFT
Adolph Atencio, Jr., Jerry V. Kirk, Paul T. Soderman, and Leo P. Hall Oct. 1972 53 p refs Prepared in cooperation with Army Air Mobility Res. and Develop. Lab.
(NASA-TM-X-62182) Avail: NTIS HC $4.75 CSCL 01B

Wind tunnel tests to determine noise data from scale model research aircraft are discussed. Comparisons are made between data obtained in wind tunnels and results of full scale flight tests. The acoustic measurements for the XV-5B V/STOL fan research aircraft are presented. Author

N73-10030*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF A LARGE SCALE MODEL WITH A SWEPT WING AND AUGMENTED JET FLAP IN GROUND EFFECT
Michael D. Falarski and David G. Koenig Oct. 1972 131 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.
(NASA-TM-X-62174) Avail: NTIS HC $8.75 CSCL 01B

The investigation of the in-ground-effect, longitudinal aerodynamic characteristics of a large scale swept augmentor wing model is presented, using 40 x 80 ft wind tunnel. The investigation was conducted at three ground heights; h/c equals 2.01, 1.61, and 1.34. The induced effect of underwing nacelles, was studied with two powered nacelle configurations. One configuration used four JT-15D turbofans while the other used two J-85 turbojet engines. Two conical nozzles on each J-85 were used to deflect the thrust at angles from 0 to 120 deg. Tests were also performed without nacelles to allow comparison with previous data from ground effect. Author

N73-10031*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEPLOYABLE FLEXIBLE VENTRAL FINS FOR USE AS AN EMERGENCY SPIN RECOVERY DEVICE IN AIRCRAFT

Patent Application
Sanger M. Burk, Jr., inventor (to NASA) Filed 14 Sep. 1972 14 p
(NASA-Case-LAR-10753-1; US-Patent-Appl-SN-289018) Avail: NTIS HC $3.00 CSCL 01B

A flexible fin device for mounting on an aircraft to effect spin recovery is described. The device may be selectively deployed to provide a triangular planform of flexible material to provide spin recovery, and retracted for compact storage during nonuse. A single flexible fin may be deflected in a specific direction depending on direction of spin rotation, or two flexible fins forming an inverted V configuration may be used according to the invention. The device may be mounted on the underbody of the aircraft.
NASA

N73-10032*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF DUCT SHAPE, MACH NUMBER, AND LINING CONSTRUCTION ON MEASURED SUPPRESSOR ATTENUATION AND COMPARISON WITH THEORY
William A. Olsen, Jr., Eugene A. Krejsa, and James W. Coats Washington Nov. 1972 32 p refs
(NASA-TM-X-2652; E-7009) Avail: NTIS HC $3.00 CSCL 20A

Noise attenuation was measured for several types of cylindrical suppressors that use a duct lining composed of honeycomb cells covered with a perforated plate. The experimental technique used gave attenuation data that were repeatable and free of noise floors and other sources of error. The suppressor length, the effective acoustic diameter, suppressor shape and flow velocity were varied. The agreement among the attenuation data and two widely used analytical models was generally satisfactory. Changes were also made in the construction of the acoustic lining to measure their effect on attenuation. One of these produced a very broadband muffler. Author

N73-10033*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUMMARY OF DIRECTIONAL DIVERGENCE CHARACTERISTICS OF SEVERAL HIGH PERFORMANCE AIRCRAFT CONFIGURATIONS
H. Douglas Greer Washington Nov. 1972 63 p refs
(NASA-TN-D-6993; L-8489) Avail: NTIS HC $3.00 CSCL 01B

The present paper summarizes the high-angle-of-attack characteristics of a number of high-performance aircraft as determined from model force tests and free-flight model tests and correlates these characteristics with the dynamic directional-stability parameter. This correlation shows that the dynamic directional-stability parameter correlates fairly well with directional divergence. Data are also presented to show the effect of some airframe modifications on the directional divergence potential of the configuration. These results show that leading-edge slates seem to be the most effective airframe modification for reducing or eliminating the directional divergence potential of aircraft with moderately swept wings. Author

N73-10034*# Scientific Translation Service, Santa Barbara, Calif.
LATEST CIVILIAN V/STOL AIRCRAFT PROJECTS OF HAWKER SIDDELEY AVIATION, CONTINUATION FROM FR6/71
T. K. Szlenkier Washington NASA Nov. 1972 22 p Transl. into ENGLISH from Flug-Rev. Int. (West Germany), Jul. 1971 p 35-38 and 43-46
(Contract NASw-2035)
(NASA-TT-F-14629) Avail: NTIS HC $3.25 CSCL 01B

The latest civilian V/STOL aircraft are examined. It is found that such aircraft are more economical and convenient in short air flights, require lower capital investments compared with other systems, and have less influence on the environment. Author

N73-10035# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
AERODYNAMICS OF WING-SLIPSTREAM INTERACTION: A NUMERICAL STUDY
N. D. Ellis Sep. 1971 92 p refs
(Grant AF-AFOSR-1885-70; AF Proj. 9781)
(AD-743257; UTIAS-169; AFOSR-71-3086TR) Avail: NTIS CSCL 01/1

A fundamental theory of wing-slipstream interaction accounts for slipstreams of arbitrary cross-section by means of vortex sheaths. These sheaths together with the wing circulation pattern are dictated by the boundary conditions; the analysis leads to simultaneous integral equations for their determination. In a multiple lifting line approximation these are ultimately reduced to simultaneous linear algebraic equations for machine inversion. Programs for digital computer have been developed for the case of round slipstreams distributed with lateral symmetry on a rectangular wing. Author (GRA)

N73-10036# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
AIRDROP SYSTEM COMPONENTS Final Report
20 Apr. 1972 65 p refs
(AD-744811; MTP-7-2-510) Avail: NTIS CSCL 14/2

The objective of this Materiel Test Procedure is to describe the engineering procedures required to determine the operational suitability of various airdrop system components including parachutes, platforms, harness and hardware. Author (GRA)

N73-10037# Naval Postgraduate School, Monterey, Calif.
AN EVALUATION OF THE LONGITUDINAL DYNAMIC STABILITY OF AN AIRCRAFT AT STALL M.S. Thesis
John Thomas Frederiksen Jun. 1972 74 p refs
(AD-745557) Avail: NTIS CSCL 01/3

The longitudinal stability of an aircraft at or near stall was examined using the digital computer as an experimental tool to solve the longitudinal equations of motion. A linear analysis determined the effect of lift curve slope variation. An investigation was made to identify the nonlinear lift curve variations needed to create the often observed rocking-chair or porpoising stall trait. The characteristics of this limit-cycle oscillation were examined. Author (GRA)

N73-10038# Naval Postgraduate School, Monterey, Calif.
EVALUATION OF MINIMUM AIRCRAFT FLYING SPEED BY DIGITAL SIMULATION M.S. Thesis
Carlton Wayne Saul Jun. 1972 73 p refs
(AD-745861) Avail: NTIS CSCL 01/2

Aircraft minimum flying speed, as determined by actual flight test, is published in aircraft handbooks for pilot guidance. The test flight results are used to determine and confirm take-off and landing speeds, field lengths, left-hand portion of the maneuvering envelopes (V-n diagram), etc. Determination of the absolute minimum flying speed of an aircraft on the other hand, has not been of prime importance in flight test. In the present analysis digital simulation allowed by systematic study of not only the minimum flying speed as defined by Federal Aviation Regulations but also the absolute minimum flying speed attainable in steady, unaccelerated flight. The study included such effects as deceleration rate, rate of change of elevator angle, aircraft weight and pitch moment of inertia.
Author (GRA)

N73-10039# Naval Postgraduate School, Monterey, Calif.
A GUIDE TO AND AN ABSTRACTED BIBLIOGRAPHY OF AIRCRAFT SIDE ARM CONTROL STICK RESEARCH M.S. Thesis
Norio Bruce Endo Jun. 1972 44 p refs
(AD-745863) Avail: NTIS CSCL 01/3

An expanding interest at the Naval Postgraduate School, Monterey, California, in research work on aircraft side-arm control sticks has necessitated the determination of the previous and ongoing projects involved with the development of side-arm control sticks. This paper presents a survey of the English language literature dealing with aircraft control sticks over the period of 1936 to 1971. The result of the survey is an abstracted bibliography of significant literature related to the design and testing of aircraft control sticks and a guide to the literature.
Author (GRA)

N73-10040# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
BRIEFS OF ACCIDENTS INVOLVING CORPORATE/EXECUTIVE AIRCRAFT: US GENERAL AVIATION, 1970
1972 56 p
(PB-210247; NTSB-AMM-72-5) Avail: NTIS HC $3.00 CSCL

01B
The publication contains statistical, cause/factor and injury tables, accident rates and the briefs of accidents involving corporate executive aircraft during 1970. Author (GRA)

N73-10041# Boeing Co., Seattle, Wash. Military Aircraft Systems Div.
INTEGRATED INFORMATION PRESENTATION AND CONTROL SYSTEM STUDY. VOLUME 3: DEGRADED MODE ANALYSIS Final Report, Jun. 1970 - Mar. 1971
S. J. Premselaar, J. F. Hatcher, R. L. Richardson, R. L. Kinnamen, and W. D. Smith Jun. 1971 162 p refs
(Contract F33615-70-C-1832; AF Proj. 6190)
(AD-740435; AFFDL-TR-70-79-Vol-3) Avail: NTIS CSCL 01/3

Integrated Information Presentation and Control System (IIPACS-1) was selected as the baseline configuration for systematic degraded mode analyses. The cockpit concept was evaluated subjectively and by means of a computerized workload analysis. The results of the analyses and evaluations, conducted to determine the control and display requirements for contingency operations, are reported. Author (GRA)

N73-10042# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
TAKEOFF AND LANDING ANALYSIS (TOLA) COMPUTER PROGRAM. PART 1: CAPABILITIES OF THE TAKEOFF AND LANDING ANALYSIS COMPUTER PROGRAM
Urban H. D. Lynch Feb. 1972 50 p refs
(AF Proj. 1431)
(AD-741942; AFFDL-TR-71-155-Pt-1) Avail: NTIS CSCL 01/2

The program provides a complete simulation of the aircraft takeoff and landing problem. Effects simulated in the program include: aircraft control and performance during glide slope, flare, landing roll, and takeoff roll, all under conditions of changing winds, engine failures, brake failures, control system failures, strut failures, runway length and control variable limits, and time lags; landing gear loads and dynamics for aircraft with up to five gears; multiple engine aircraft; engine reversing; drag chute and spoiler effects; braking; aerodynamic ground effect; takeoff from aircraft carriers; and inclined runways and runway perturbations. The program is modular so that glide slope, flare, landing, and takeoff can be studied separately or in combination. Author (GRA)

N73-10043# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
NINETEEN RULES FOR AVIONICS DESIGN ENGINEERS
Albert Goldman May 1972 12 p
(AD-746029; AFAL-TR-72-113) Avail: NTIS CSCL 09/3

Despite the use of integrated circuits, military avionics equipment has increased in cost and complexity, so that acceptable reliability is still a problem. As an aid to designers of avionics subsystems, nineteen rules for assuring reliable products and avoiding possible pitfalls in test and evaluation activities are presented. Author (GRA)

N73-10044# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ANALYSIS OF PILOTED WEAPON DELIVERY: STRAFING PERFORMANCE OF A FOREIGN AIRCRAFT M.S. Thesis
William P. Hartmann Jun. 1972 75 p refs
(AD-745997; GGC/EE/72-4) Avail: NTIS CSCL 01/3

In order to determine whether the weapon delivery accuracy of an aircraft for which the aerodynamic stability derivatives were not known could be estimated, the strafing performance of an unspecified foreign tactical fighter was analyzed. The stability derivatives were estimated from the physical characteristics of the aircraft using standard stability and control methods. Also, by the use of classical control theory, the probable control system of the aircraft was formulated. Then, with an analytical pilot model in the aircraft's control loop, the tracking error was estimated and combined with other pilot-induced errors in a statistical model which predicts impact errors. Author (GRA)

N73-10045# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ANALYSIS OF PILOTED WEAPON DELIVERY: F-4C DIVE BOMBING M.S. Thesis
Robert John Hovde Jun. 1972 101 p refs
(AD-745999; GGC/EE/72-6) Avail: NTIS CSCL 01/3

A model of the pilot-aircraft system is used to relate pilot tracking performance to overall weapon delivery accuracy. This permits the evaluation of the control and guidance aspects of manual weapon delivery in terms of the closed-loop parameter of impact error. All essential task problems are evaluated as integral elements of weapon delivery rather than as isolated subsystems. Specifically, a linear expression for impact error is developed in terms of the task variables directly under the pilot's control. By considering each of the pilot inputs to be a random variable, a statistical model of the propagation of the pilot-induced errors into impact errors is developed. Author (GRA)

N73-10046# Transportation Systems Center, Cambridge, Mass.
THE CALCULATION OF AIRCRAFT COLLISION PROBABILITIES Technical Report, 1971
Juan F. Bellantoni Oct. 1971 43 p refs
(AD-744722; DOT-TSC-FAA-71-27) Avail: NTIS CSCL 01/2

The paper extends the statistical-probabilistic method of collision probability calculation, which has been limited to parallel, straight line flight paths, to arbitrary flight paths and vehicle shapes. The general formula is specialized to the cases of large relative velocity, non-zero relative velocity, zero relative velocity, and spherical collision surface. The formulas are applied to independent curved landing approaches to parallel runways. Author (GRA)

N73-10047# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
STUDY OF IMPULSIVE SOUND GENERATED BY ROTOR TIPS ACCELERATING NEAR THE SONIC SPEED Final Report, 25 Jun. 1969 - 24 Jun. 1971
Richard H. Lyon 30 Jun. 1972 6 p refs
(Contract DAHC04-69-C-0085)
(AD-746287; AROD-8705-2-E) Avail: NTIS CSCL 20/1

The report describes findings resulting from a continuing study of helicopter rotor generated noise. Noise reduction efforts are presented. GRA

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; Nuclear Engineering; and 28 Propulsion Systems.

N73-10048# Aeronautical Research Labs., Melbourne (Australia).
HIGH TEMPERATURE FUEL CELLS: CHARTS FOR THERMODYNAMIC EQUILIBRIA AND CARBON DEPOSITION IN THE C-H-O SYSTEM
D. R. Hearn and L. W. Hillen Feb. 1972 45 p refs
(ARL/ME-Note-333) Avail: NTIS HC $4.25

Charts are given for carbon deposition boundaries and other thermodynamic parameters for the carbon-hydrogen-oxygen system in high temperature fuel cells. The data are applied to molten carbonate fuel cell operations. A computer program to process the data in numerical or graphical form for the system over a wide range of temperatures and pressures is developed. Author

N73-10049# Aeronautical Research Labs., Melbourne (Australia).
A dc TO dc CONVERTER POWER SUPPLY FOR AIRCRAFT DATA ACQUISITION SYSTEM TIME DISPLAY
V. R. Krieser Jan. 1972 24 p refs
(ARL/ME-Note-332) Avail: NTIS HC $3.25

A power supply was designed for use with a time-of-day display unit which forms part of an airborne data logger. To avoid the introduction of ground loop noise voltages the display is powered from the aircraft dc supply via a dc to dc converter of high effeciency. The design and operation of the power supply are described along with a performance evaluation of the assembled unit. Author

N73-10050*# Tyco Labs., Inc., Waltham, Mass.
DEVELOPMENT OF UNIFORM AND PREDICTABLE BATTERY MATERIALS FOR NICKEL-CADMIUM AEROSPACE CELLS Final Report, 8 May 1968 - 31 Jan. 1972
31 Jan. 1972 111 p refs
(Contract NAS5-11561)
(NASA-CR-130094) Avail: NTIS HC $7.75 CSCL 10A

The objective of this study was to analyze battery materials and manufacturing methods with the aim of developing uniform and predictable battery plates for nickel cadmium aerospace cells. The results are presented of an extensive factorially-designed experiment aimed at illuminating, in a comparative study, the effect of plaque preparation, plaque thickness, impregnation process, and loading level with active material. The following impregnation processes were investigated: (1) chemical conversion, (2) electrochemical conversion, and (3) high temperature electrochemical impregnation. The test parameter on which the conclusion regarding the manufacturing variables are based was the capacity change during a simulated near-earth orbit cycle regime. As operational variables, the effect of various charge and discharge rates was investigated. During the 100 test cycles, overall capacity changes of positive plates and the differences between the various plates were found to be small. Plates prepared by the high temperature electrochemical impregnation of slurry-coated plaque (at the conditions used) showed surface buildup of active material. They also retained slightly less of their capacity during cycling compared to other plate preparations.
Author

N73-10051*# National Aeronautics and Space Administration, Washington, D.C.
RELIABILITY ANALYSIS OF THE SOLAR GENERATOR OF THE ESRO 1 SATELLITE
Sep. 1972 24 p Transl. into ENGLISH of Soc. Anonyme de Telecommun. (Paris), no. 3015, 10 Nov. 1966 23 p
(NASA-TT-F-14498) Avail: NTIS HC $3.25 CSCL 10B

The reliability of the solar generator of ESRO 1 is studied by investigating the reliability of its components. The reliability is determined for the following components: diodes, solar cells, wiring, and panels. It is deduced that the reliability of the solar generator depends principally on the reliability of the diodes near the hottest walls.
F.O.S.

N73-10052# Colorado Univ., Boulder. Dept. of Electrical Engineering.
NONLINEAR ELECTRICAL GENERATOR STUDY, PART 2, PHASE B Final Report
Edward Alexander Erdelyi and Edward Franz Fuchs Jul. 1972 558 p refs
(Contract N00014-67-A-0405-0003)
(AD-744985) Avail: NTIS CSCL 10/2

A two-dimensional numerical analysis based on nonlinear partial difference equations of a cross section of long alternators is developed. The nonlinearity of the magnetic materials, the complicated contours of the cross-section of the alternators, and the various current density fields are fully considered. The new analysis is applied for the predetermination of the synchronous and transient reactances of large salient pole alternators and turbogenerators. The calculations were made for a General Electric Company alternator of the following data: 82.5 MVA, 16.5 kV, wye-connected, 40 poles, 180 rpm and 60 Hz, and for a Westinghouse Electric Corporation 200 MVA, 15 kV, wye-connected, four pole, 50 Hz turboalternator.
Author (GRA)

N73-10053# Army Foreign Science and Technology Center, Charlottesville, Va.
A STUDY OF PHOTOVOLT GENERATOR AT HIGH RADIATION INTENSITY
A. P. Landsman and D. S. Strebkov 13 Jun. 1972 5 p refs Transl. into ENGLISH from Geliotekhnika, Akad. Nauk Uz. SSR (Tashkent), no. 3, 1970 p 3-6
(AD-745364; FSTC-HT-23-1014-72) Avail: NTIS CSCL 10/2

The new high voltage photoelectric generator Photovolt is described. The spectral sensitivity and current-voltage characteristics are given. The generator efficiency rises from 7% to 10% while the light power increases from normal value up to 4 kw/sq m.
Author (GRA)

N73-10054# Army Foreign Science and Technology Center, Charlottesville, Va.
TRANSITION PROCESSES IN THERMOELECTRIC DEVICES
L. V. Vengerovskii, M. A. Kaganov, and A. S. Rivkin 18 May 1972 22 p refs Transl. into ENGLISH from Sb. Tr. Agron. Fiz. (Leningrad), no. 25, 1970
(AD-744683; FSTC-HT-23-1458-72) Avail: NTIS CSCL 10/2

A calculation of transitional thermal processes on a thermoelement cold junction under mixed thermoloading is discussed.
Author (GRA)

N73-10055# Army Foreign Science and Technology Center, Charlottesville, Va.
APPLICATIONS OF AIRCRAFT GAS TURBINE ENGINES IN INDUSTRIAL POWER PLANTS
V. Kh. Vyants 3 Apr. 1972 11 p Transl. into ENGLISH from the book "Gazovye Turbiny" Moscow, 1971 p 42-48
(AD-745832; FSTC-HT-23-1423-72) Avail: NTIS CSCL 10/2

Recently, a new branch of technology, based on the use of aircraft gas turbine engines in electric and transport power plants has been developed, using both new engines and those which have been run out for aviation purposes. The mass production of aviation engines is well tuned up in economically developed countries and their great reserve, especially at the low rate with which they are operated in industrial plants, conditions the technical and economic expedience of their use in this fashion. The basic advantages of installations with aircraft engines by comparison with specially created installations are given.
Author (GRA)

N73-10056# Army Foreign Science and Technology Center, Charlottesville, Va.
SPACE ELECTRIC POWER PLANTS, PART 1
N. Lidorenko 1972 8 p Transl. into ENGLISH from Pravda (Moscow), no. 160, 9 Jun. 1971 p 3
(AD-741524; FSTC-HT-23-923-72-Pt-1) Avail: NTIS CSCL 10/2

The theoretical aspect of solar power plants of Soviet spacecraft is explained by Lidorenko, an expert in the field of rechargeable power sources. Development of solar batteries for Lunokhod-1 solves new problems. The type of semiconductor chosen performs well in the 100-150 C and withstands vigorous cooling. The semiconductor passed through a lunar eclipse intact when the cover of the Lunokhod was left open.
Author (GRA)

N73-10057# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
ANALYSIS OF POTENTIAL PLUME CONTAMINATION EFFECTS RESULTING FROM TWO 300 POUND BIPROPELLANT ENGINES OPERATING IN A SATELLITE ENVIRONMENT Technical Report, 15 Jan. - 15 May 1972
W. T. Webber, R. J. Hoffman (AFRPL), and J. R. Nunn Edwards AFB, Calif. AFRPL Jun. 1972 71 p refs
(Contract F04611-72-C-0037)
(AD-746306; MDC-G3693; AFRPL-TR-72-66) Avail: NTIS CSCL 10/2

Two bipropellant rocket engines were analyzed for total plume contaminant production and a specific vehicular effect of the vehicle-deposited contaminant when operated with a prescribed satellite configuration and engine duty cycle. The two engines analyzed were the Rocketdyne RS-2101 and the Marquardt R 23-B. The vehicular effect analyzed was electrical power loss from degradation of the solar cell array.
GRA

N73-10058# General Electric Co., Gainesville, Fla. Battery Products Section.
NICKEL HYDROXIDE BATTERY ELECTRODE DEVELOPMENT Final Technical Report, 1 Jan. 1971 - 31 Jan. 1972
Hanns H. Kroger Wright-Patterson AFB, Ohio. AFAPL Jul. 1972 239 p
(Contract F33615-69-C-1312)
(AD-746335; AFAPL-TR-72-35; Rept-72-BPS-02) Avail: NTIS CSCL 10/3

The report terminates the work on a three-year program aimed at the development of an improved nickel hydroxide electrode for the use in rechargeable alkaline batteries for aerospace applications. The improvements sought were primarily

concerned with achieving a better nickel electrode performance with respect to energy density, charge efficiency, and capacity reproducibility. The problems and improvements are discussed. An electrodeposition process was developed. GRA

N73-10984* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Guidance and Control Div.
XENON FILLED SILICON GERMANIUM THERMOELECTRIC GENERATORS
F. DeWinter *In its* JPL Quart. Tech. Rev., Vol. 2, No. 3 Oct. 1972 p 22-31 refs (For availability see N73-10981 01-34) CSCL 10B

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N73-10059*# California Univ., Berkeley. Dept. of Soils and Plant Nutrition.
ENZYME ACTIVITY IN TERRESTRIAL SOIL IN RELATION TO EXPLORATION OF THE MARTIAN SURFACE Semiannual Progress Report
M. S. Ardakani, A. D. McLaren, and A. H. Pukite 1 Jul. 1972 26 p refs
(Grant NGL-05-003-079)
(NASA-CR-128399; SAPR-16; SSL-Ser-13-Issue-76) Avail: NTIS HC $3.50 CSCL 06M

An exploration was made of enzyme activities in soil, including abundance, persistence and localization of these activities. An attempt was made to develop procedures for the detection and assaying of enzymes in soils suitable for presumptive tests for life in planetary soils. A suitable extraction procedure for soil enzymes was developed and measurements were made of activities in extracts in order to study how urease is complexed in soil organic matter. Mathematical models were developed, based on enzyme action and microbial growth in soil, for rates of oxidation of nitrogen as nitrogen compounds are moved downward in soil by water flow. These biogeochemical models should be applicable to any percolating system, with suitable modification for special features, such as oxygen concentrations, and types of hydrodynamic flow. Author

N73-10060# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).
SUMMARIES, BIOLOGICAL EFFECTS OF MICROWAVE RADIATION, PART 5
P. M. M. VanOsch and H. Heering Apr. 1972 91 p
(MBL-1972-5; TDCK-59853) Avail: NTIS HC $6.75

Summaries of research on the biological effects of microwave exposure are reported. Studies included are: survival rate of panirradiated guinea pigs, indices of fertility for irradiated female mice, and the effect of microwaves on bone, bone marrow, and adjacent tissues. F.O.S.

N73-10061# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).
SUMMARIES, BIOLOGICAL EFFECTS OF MICROWAVE RADIATION, PART 6
H. Heering and P. M. M. VanOsch May 1972 89 p
(MBL-1972-6; TDCK-59854) Avail: NTIS HC $6.50

Abstracts on the biological effects of microwave radiation on humans and animals are presented. Data cover hemodynamic responses, biological rhythm changes, muscular reflexes, eye sight decrement, and various other physical damages and effects on life expectancy of exposed individuals. E.H.W.

N73-10062*# Naval Aerospace Medical Research Lab., Pensacola, Fla.
DIRECTION-SPECIFIC ADAPTATION EFFECTS ACQUIRED IN A SLOW ROTATION ROOM
Ashton Graybiel and James Knepton 11 Jul. 1972 21 p refs (NASA Order W-13433)
(NASA-CR-129063; NAMRL-1162) Avail: NTIS HC $3.25 CSCL 06S

Thirty-eight subjects were required to execute 120 head movements in a slow rotation room at each 1-rpm increase in velocity of the room between 0 and 6 rpm and, after a single-step gradual return to zero velocity, execute 120 head movements either immediately after the return or after delay periods varying from 1 to 24 hours unless, at any time, more than mild symptoms of motion sickness were elicited. A second stress profile differed by the sequential addition of an incremental adaptation schedule in which the direction of rotation was reversed. The experimental findings demonstrated the acquisition of direction-specific adaptation effects that underwent spontaneous decay with a short time constant (hours). Speculations are presented which could account for the simultaneous acquisition of short-term and long-term adaptation effects. The findings support the theory that motion sickness, although a consequence of vestibular stimulation, has its immediate origin in nonvestibular systems, implying a faculative or temporary linkage between the vestibular and nonvestibular systems. Author

N73-10063*# Lunar Science Inst., Houston, Tex.
[EFFECTS OF APOLLO 12 LUNAR MATERIAL ON LIPID LEVELS OF TOBACCO TISSUE AND SLASH PINE CULTURES] Progress Report
John D. Weete 1 Oct. 1972 55 p refs
(Contract NAS9-12622)
(NASA-CR-128606) Avail: NTIS HC $4.75 CSCL 06A

Investigations of the lipid components of pine tissues (Pinus elloitii) are discussed, emphasizing fatty acids and steroids. The response by slash pine tissue cultures to growth in contact with Apollo lunar soil, earth basalt, and Iowa soil is studied. Tissue cultures of tobacco grown for 12 weeks in contact with lunar material from Apollo 12 flight contained 21 to 35 percent more total pigment than control tissues. No differences were noted in the fresh or dry weight of the experimental and control samples. J.A.M.

N73-10064*# Ohio State Univ. Research Foundation, Columbus. Aviation Medicine Research Lab.
THE INTERACTION OF INFRARED RADIATION WITH THE EYE: A REVIEW OF THE LITERATURE
H. Spencer Turner [1972] 87 p refs
(Contract NSR-36-008-108)
(NASA-CR-128407) Avail: NTIS HC $6.50 CSCL 06P

A compilation of data concerning the effects of infrared radiation on the eye is presented. Information in the following areas is included: (1) transmission and absorption of infrared radiation by the ocular tissues, (2) range of infrared radiation which is harmful to the ocular tissues, (3) infrared radiation thresholds of the various oscular tissues, and (4) infrared radiation transmission and absorption of current optic materials. F.O.S.

N73-10065*# Ohio State Univ. Research Foundation, Columbus. Aviation Medicine Research Lab.
HUMAN RESPONSES TO ELECTRICITY: A LITERATURE REVIEW
H. Spencer Turner [1972] 115 p refs
(Contracts NSR-36-008-108; BCL-RF209-032/103)
(NASA-CR-128422) Avail: NTIS HC $7.75 CSCL 06P

An extensive review of literature on research concerning biomedical sensors is presented for establishing standards for current limiting devices. The physiological and pathological responses of the human, when exposed to electricity are reported including the thresholds: for perception of electricity, pain by electric current, induction of muscular contraction by electric shock, and ventricular fibrillation. The passive electrical properties of cells and tissues are also reported. F.O.S.

N73-10066*# Techtran Corp., Glen Burnie, Md.
THE QUESTION OF WATER AND ELECTROLYTE LEVELS AT HIGH TEMPERATURES
L. Schmidt Washington NASA Oct. 1972 19 p Transl into ENGLISH from Arbeitsmed. - Sozialmed. - Arbeitshyg. (West Germany), v. 2, 1966 p 44-50
(Contract NASw-2037)
(NASA-TT-F-13915) Avail: NTIS HC $3.00 CSCL 06P

Physiological regulatory mechanisms governing the water and electrolyte levels in the body are studied, together with the various disturbances caused during work at high temperatures. Author

N73-10067*# Techtran Corp., Glen Burnie, Md.
UNDERSTANDING THE EFFECT OF CALCIUM-DEFICIENT DIET ON THE COMPOSITION OF GROWING BONE
Stephan Weiser Washington NASA Oct. 1972 24 p refs Transl. into ENGLISH from Biochem. Z. (West Germany), v. 66, 1914 p 95-114
(Contract NASw-2037)
(NASA-TT-F-13917) Avail: NTIS HC $3.25 CSCL 06P

Feeding a calcium-deficient diet to pigs and dogs leads to reduced weight gain and changes in bone structure. Detailed tables illustrate results of analysis of bones and bone ash from animals fed calcium-rich and calcium-deficient diets. Author

N73-10068*# Techtran Corp., Glen Burnie, Md.
INVESTIGATION OF THE BIOSYNTHESIS OF UNSATURATED FATTY ACIDS IN YEAST
J. Schultz and F. Lynen Washington NASA Oct. 1972 16 p refs Transl. into ENGLISH from Eur. J. Biochem. (West Germany), v. 21, 1971 p 48-54
(Contract NASw-2037)
(NASA-TT-F-13918) Avail: NTIS HC $3.00 CSCL 06H

Palmitoyl-CoA and other longchain acyl-CoA derivatives were purified by counter current distribution or by partition chromatography. The particle bound acyl-CoA desaturase from baker's yeast was isolated. This microsomal fraction contained a considerable amount of fatty acid synthetase which was removed from the microsomes by ultrasonic treatment. There is no indication that transfer of an acyl residue from CoA to the enzyme as a first step occurs in the reaction sequence. The enzyme reaction is not inhibited by SH-blocking reagents. It is concluded that an AC-protein-like component does not participate in the enzymatic desaturation of fatty acids in yeast. The Michaelis constants for the substrates stearoyl-, palmitoyl- and myristoyl-CoA for the desaturation reaction were determined. Author

N73-10069*# Techtran Corp., Glen Burnie, Md.
STUDIES OF THE SURVIVAL TIME OF BACTERIA ON SURFACES AND THE POSSIBILITIES OF INFLUENCING IT. 3: INFLUENCE OF VARIOUS LIGHTING CONDITIONS AND PREVIOUS DISINFECTION IN THE USE OF PLASTICS
K. O. Gundermann and S. Glueck Washington NASA Oct. 1972 13 p refs Transl. into ENGLISH from Arch. Hyg. Bakteriol. (Munich), v. 154, no. 5, 1971 p 480-487
(Contract NASw-2037)
(NASA-TT-F-13923) Avail: NTIS HC $3.00 CSCL 06M

The examination of the survival time of bacteria on plastics revealed an unequivocal, inherent bactericidal effect of some materials as well as an at least unfavorable effect on the germs of some others when all test conditions were taken into consideration. The strong influence of the daylight on the lifetime could be confirmed again. The late effect of disinfectants is in part dependent on the surface material. The phenolic agent, for instance, showed a considerable late effect on polyethylene, polystyrene, polyproplene, polycarbonate, phenolic resin, and acrylic glass; the delayed effect of this agent was reduced in the case of PVC and polyacetal. Author

N73-10070*# Translation Consultants, Ltd., Arlington, Va.
COMPLETE AND ISOENZYME CONTENT OF LACTATE DEHYDROGENASE IN PLASMA, LEUKOCYTES AND ERYTHROCYTES IN MYELOPROLIFERATIVE DISEASES
W. A. Helbig, K. Parthum, and H. J. Sommer Washington NASA Nov. 1972 12 p refs Transl. into ENGLISH from Folia Haematol. (Leipzig), v. 95, no. 3, 1971 p 229-237
(Contract NASw-2038)
(NASA-TT-F-14586) Avail: NTIS HC $3.00 CSCL 06P

Examinations of the complete activity of LDH and its isoenzymes in plasma and in myeloid cells revealed clear differences between healthy persons and patients with myeloproliferative diseases. Even within the latter group there were differences which can be used for a differential diagnosis. However, the long time which is required to isolate the cells, to represent the isoenzymes, and to evaluate them will cause this method to be applied only in special laboratories or for special cases. Author

N73-10071*# Translation Consultants, Ltd., Arlington, Va.
PRE- AND POSTOPERATIVE FLUID THERAPY
H. Breivik Washington NASA Nov. 1972 7 p refs Transl. into ENGLISH from Tidsskr. Norske Laegeforen. (Oslo), v. 89, 1969 p 1029-1030
(Contract NASw-2038)
(NASA-TT-F-14600) Avail: NTIS HC $3.00 CSCL 06E

The administration of Ringers lactate solution in pre- and postoperative fluid therapy is discussed and its advantages described. Author

N73-10072*# Techtran Corp., Glen Burnie, Md.
COMPARISON OF THE DEVELOPMENT OF THE VESTIBULAR (LABYRINTH) OF THE FROG RANA TEMPORARIA IN CONDITIONS OF WEIGHTLESSNESS
Ya. A. Vinnikov, O. G. Gazenko, L. K. Titova, V. I. Govardovskiy, F. G. Gribakin, A. A. Bronshteyn, R. A. Pevzner, M. Z. Aronova, A. L. Mashinskiy, L. R. Palmbakh et al Washington NASA Nov. 1972 15 p refs Transl. into ENGLISH from Zh. Evol. Biokhim. Fiziol. (Leningrad), v. 8, no. 3, May-Jun. 1972 p 343-349
(Contract NASw-2037)
(NASA-TT-F-14624) Avail: NTIS HC $3.00 CSCL 06P

For a period of four days eggs of the frog Rana temporaria were investigated in both terrestrial conditions and in conditions of weightlessness. The embryos were placed in a special container which was equipped with a small tank containing a fixing fluid. In the terrestrial conditions, as the control, and in the experimental conditions, the embryos were maintained for a period of two days, during which the segmentation occurred with the formation of blastulae and the initial formation of gastrulation. In both terrestrial conditions and in conditions of weightlessness the frog embryos which were fixed at the stage of tail budding were seen to have a normal development of the auditory vesicle - the future vestibular apparatus - and the beginning of differentiation of the receptor and supporting cells, as well as the bipolar neuroblasts of the eighth ganglion. Author

N73-10073# Joint Publications Research Service, Arlington, Va.
HYGIENIC PROBLEMS OF THE EFFECT OF MICROWAVE ELECTROMAGNETIC FIELDS ON THE BODY
M. P. Troyanskiy 10 Oct. 1972 9 p refs Transl. into ENGLISH from Gigiena i Sanit. (Moscow), no. 8, 1972
(JPRS-57209) Avail: NTIS HC $3.00

The harmful effects of microwave fields on the human body, the determination of maximum permissible human exposure levels, and the development of preventive and protective measures are studied. Author

N73-10074*# Translation Consultants, Ltd., Arlington, Va.
INPUT AND OUTPUT IN THE SYSTEM OF THERMOREGULATION DURING REST AND EXERCISE
M. Scarperi, S. Scarperi, K. Behling, A. Bleichert, and J. Kitzing Washington NASA Nov. 1972 10 p refs Transl. into ENGLISH from Intern. Z. Angew. Physiol. (Berlin), v. 30, 1970 p 186-192
(Contract NASw-2038)
(NASA-TT-F-14562) Avail: NTIS HC $3.00 CSCL 06P

Sweat rate and heat conductance remain nearly constant despite a steady increase in core temperature during experiments in a hot environment. The water loss during the experiments must be taken in account in input-output correlations. Water loss during the experiments was replaced. The correlation equations described hold without a correction factor. Esophageal temperature during exercise in these experiments was steady in the first 1/2 hour. After 2 hours esophageal temperature in a warm climate is markedly lower than in the control experiments. Author

N73-10075*# California Univ., Davis. Dept. of Animal Physiology.
THE FOUNDATIONS OF SPACE BIOLOGY AND MEDICINE. VOLUME 2: ECOLOGICAL AND PHYSIOLOGICAL BASES OF SPACE BIOLOGY AND MEDICINE. PART 3: EFFECT ON THE ORGANISM OF DYNAMIC FLIGHT FACTORS. CHAPTER 1: PRINCIPLES OF GRAVITATIONAL BIOLOGY
Arthur H. Smith [1972] 94 p refs Supported by NASA (Grant NGR-05-004-008)
(NASA-CR-128471) Avail: NTIS HC $6.75 CSCL 06S

The physical principles of gravitation are discussed, such as

gravitational and intertial forces, weight and mass, weightlessness, size and scale effects, scale limits of gravitational effects, and gravity as a biogenic factor. The behavior of the accelerative force gravitation, is described. This law proposes and quantifies the mutual gravitational attraction existing between all bodies of matter, the force being proportional to the product of masses, and inversely related to the square of the distance separating them. Gravity orientation, chronic acceleration, and hematology are examined. Systematic responses, such as circulation and renal functions, are also considered, along with animal response to a decreased acceleration field and physiology of hyper- and hypodynamic fields. J.A.M.

N73-10076# Defence Research Information Centre, Orpington (England).
LESIONS OF THE NERVOUS SYSTEM IN DECOMPRESSION SICKNESS
M. P. Elinskii May 1972 12 p refs Transl. into ENGLISH from Vopr. Psikhiat. i Neuropatol. (USSR) v. 13, 1968 p 615-622 Presented at Symp. on Psykhiat. and Neuropathol., Leningrad, 1968
(AD-743330; DRIC-Trans-2790; BR-30161) Avail: NTIS CSCL 06/5

Of all the pathological conditions brought about by the effects of anomalous conditions in the surrounding air media, the most serious is the disease associated with rapid reduction of the atmospheric pressure. Such diseases are termed decompression sickness. Where there is considerable and rapid reduction of pressure, the gases dissolved in the blood and tissue separate out in the form of bubbles and form vascular embolisms and local affection of the tissue. Such sickness is encountered in ascents to high altitudes (above 8000 m), caisson work, diving operations, deep diving sport, pressure chamber research, etc. Affection of the nervous system is one of the most serious complications, and is important as a symptom of decompression sickness. Several characteristic features of the clinic course of the illness which is accompanied by affection of the nervous system are described. GRA

N73-10077# Defence Research Establishment Ottawa (Ontario).
RELATIONSHIPS BETWEEN DOSIMETER RESPONSE AND ABSORBED DOSE FOR 0.66-MeV GAMMA RAYS AND FOR 2.9-MeV NEUTRONS
Charles E. Clifford and Robert A. Facey Mar. 1972 13 p refs (DRB Proj. 16-01-39)
(AD-743005; DREO-TN-72-12) Avail: NTIS CSCL 06/18

The dose at sites in the interior and on the surface of a human phantom was measured for broad-beam exposure to 0.66-MeV gamma rays and to 2.95-MeV neutrons. Measurements were made for a range of angles of radiation incidence. A comparison is presented between the surface dose at possible dosimeter locations on the chest, abdomen and groin and the corresponding absorbed dose to the bone-marrow system and to the abdomen. Unless the geometry of exposure is accurately known, it is shown that a chest dosimeter is a poor indicator of the absorbed dose. A dosimeter worn on the groin would be significantly better for both neutrons and gamma rays for a wide range of exposure geometries. Author (GRA)

N73-10078# School of Aerospace Medicine, Brooks AFB, Tex.
COMPUTER PROGRAM FOR ACTIVITY DETERMINATIONS IN THE USAFSAM WHOLE-BODY COUNTER Final Report, Jan. - May 1970
Ted D. Rupp and Robert C. Nelson Jun. 1972 43 p refs (AF Proj. 7757)
(AD-745578; SAM-TR-72-10) Avail: NTIS CSCL 06/18

Omega is a very low frequency (VLF) navigation system which will give world-wide coverage with eight stations when fully implemented. Using published skywave correction tables accuracies of 1 to 2 n.mi. are attainable. Through the use of differential Omega, correction information can be disseminated to users in the vicinity of a monitor site. Differential Omega accuracies are directly proportional to distance from the monitor site and are 0.26 - 0.5 n.mi. at 200 n.mi. from the monitor site. A system using U.S. Coast Guard radiobeacons as the differential information transmitter was proposed by Goodman and McKaughan. Their proposals were examined and improvements suggested. Two additional differential Omega systems being proposed by civilian contractors were also examined. Author (GRA)

N73-10079# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A METHOD FOR CALCULATING AIRCREW RADIATION DOSE M.S. Thesis
John A. Bachman Jun. 1972 84 p refs
(AD-745084; GNE/PH/72-1) Avail: NTIS CSCL 06/18

A method was developed to estimate the radiation dose received by an aircrew member in an aircraft in the vicinity of an atmospheric nuclear weapon detonation. The problem is segmented into three parts; determining the radiation field at the aircraft, determining the radiation field within the aircraft, and calculating the radiation dose absorbed by the crew member. The air portion is solved using a computer code with some special treatment of the results, and existing fluence-to-dose conversion factors are used for calculating the crew member dose. The treatment of the aircraft attenuation is developed. The scattered fluence is determined using multigroup diffusion theory. A sample problem is presented using the F-102A interceptor and a hypothetical burst. Author (GRA)

N73-10080# Armed Forces Radiobiology Research Inst., Bethesda, Md.
NEUTRON EFFECTIVENESS FOR CAUSING INCAPACITATION IN MONKEYS
J. W. Thorp and R. W. Young Apr. 1972 18 p refs
(AD-742076; AFRRI-SR72-5) Avail: NTIS CSCL 06/18

Fifty-eight male monkeys (Macaca mulatta) were trained by shock avoidance conditioning to work a simultaneous visual discrimination problem. Trained subjects were irradiated in either a nuclear reactor-produced neutron field (incident neutron to gamma ray ratio of about 10) or a similarly produced gamma ray field (incident neutron to ratio of about 0.1). In all exposures the midbrain dose rate was about 2000 rads/minute. The midbrain dose most likely to cause early transient incapacitation(ETI) in 50 percent of the irradiated subjects was determined. The signs and symptoms of ETI were the same whether the monkey received gamma or neutron radiations. Author

N73-10081# North Carolina Univ., Chapel Hill.
INTERRELATION OF SYSTEMIC AND CELLULAR RESPONSES TO ACUTE AND CHRONIC HYPOXIA Final Report, 1 Jan. 1963 - 31 Dec. 1970
A. T. Miller, Jr. 4 Nov. 1971 59 p refs
(Contract DA-49-193-MD-2371)
(AD-743536) Avail: NTIS CSCL 06/19

A number of separate, though interrelated projects are described in this report. They are grouped into two major categories - (1) the effects of hypoxia on cell metabolism, and (2) the effects of hypoxia on behavior. One of the major objectives was a study of certain features of the process of acclimation to simulated high altitude. This included (a) the effects of altitude acclimation on cellular metabolic and behavioral responses to acute hypoxia, (b) the effects of altitude acclimation on one of the enzymes important to anaerobic metabolism (latic dehydrogenase) and on the relative vascularity of brain, heart and skeletal muscle, (c) the adaptive value of two of the prominent changes observed at altitude (hyperventilation and polycythemia), and (d) an attempt to determine the stimulus responsible for the increased vascularity of organs in altitude-acclimated animals. Author (GRA)

N73-10082# Naval Postgraduate School, Monterey, Calif.
A STUDY OF UNDERWATER DIVER TACTILE SENSITIVITY M.S. Thesis
David Lee McKee Mar. 1972 53 p refs
(AD-743709) Avail: NTIS CSCL 05/10

The thesis examines the effects of underwater submersion and prolonged underwater submersion on a diver's tactile sensitivity. The method of constant stimulus is used to determine size discrimination thresholds. The stimuli used are squares of hard acrylic plastic into which holes of varying diameters have been drilled. Four tests were administered to each subject. One test was administered on dry land in the open air and served as the standard. The other three tests were administered underwater at various time intervals. The conclusion drawn from

this research is that a diver's tactile sensitivity as measured by his ability to make size discriminations is not affected by underwater submersion or even prolonged underwater submersion of sixty-six minutes. Furthermore, the thresholds of approximately one millimeter, determined in this thesis, are consistent with the findings of past research in this field. Author (GRA)

N73-10083# Naval Aerospace Medical Research Lab., Pensacola, Fla.

COMPARATIVE EVALUATION OF EXPOSURE DISTRIBUTIONS FOR AIR TRAVELERS AND RADIATION WORKERS

Hermann J. Schaefer 25 Feb. 1972 14 p refs

(Contract DOT-FA71SS-10)

(AD-743482; NAMRL-1159) Avail: NTIS CSCL 06/18

Radiation workers contribute 0.48 millirem/year per capita of the total U.S. population. Air travelers exposed to increased environmental radiation levels at altitude contribute 0.54 millirem/year. However, the two respective distributions differ greatly in all other parameters; namely, number of individuals involved, magnitude and spread of individual exposure, and skewness. While the distribution for radiation workers centers heavily on near-zero exposures and reaches out to large excursions in rare cases of accidents, the one for air travelers shows a narrow spread, excludes excursions completely, and does not constitute an additional radiation risk. Author (GRA)

N73-10084# Naval Postgraduate School, Monterey, Calif.

THE EFFECT OF TEMPORAL UNCERTAINTY ON HUMAN ENERGY EXPENDITURE DURING MODERATE EXERCISE M.S. Thesis

Barry Grant Swanbon Mar. 1972 51 p refs

(AD-743726) Avail: NTIS CSCL 05/10

It is hypothesized that psychological attitudes affect physiological functions in humans. One function that might be affected is energy consumption during work or exercise. An experiment was conducted to examine the effect of temporal uncertainty about the duration of an exercise period on energy cost. A sample of 13 healthy, young male military officers were tested under controlled exercise routines with and without temporal uncertainty. Results indicated that there is a significant difference between similar tasks under temporal uncertainty and certainty. The task under uncertainty required less energy than the other task. Author (GRA)

N73-10085# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

A SYSTEM FOR VALIDATING HUMAN RELIABILITY DATA M.S. Thesis

Edward Low Dec. 1971 81 p refs

(AD-744551; GRE/MATH/66-5) Avail: NTIS CSCL 05/10

The human reliability data (Data Store, An Index of Electronic Equipment Operability) derived by the American Institute for Research was used to select, modify, or construct 11 indicators and controls. These indicators and controls were assembled into two panels representing the best and worst reliability figures that could be utilized. To produce realistic operational panels, little reliability difference could be made in the dimensions. The panel equipment, through a tally tape reader, was operated to simulate an aircraft flight profile from take-off to level-off. A checklist was devised varying response control indicator relationships. Trained subjects performed discrete actions in response to indications of airspeed, altitude, and vertical velocity. Their response was recorded and observed. To minimize equipment variability for higher reliability tasks, redundant error recording and interpretation was performed. Author (GRA)

N73-10086# Defence Research Information Centre, Orpington (England).

DISORDERS OF THE NERVOUS SYSTEM IN DECOMPRESSION DISEASE

G. A. Akimov May 1972 13 p refs Transl. into ENGLISH from Zh. Nevropatol. i Psikhiatr. (Moscow), no. 69, 1969 p 979-984

(AD-744298; DRIC-Trans-2788; BR-30159) Avail: NTIS CSCL 06/5

On the basis of a clinical study of 56 cases with neurological symptoms in decompression sickness (caisson disease), the authors distinguished the following varieties: cerebral forms, spinal, naural and obliterated. In 2 cases which were attributed to the cerebral (with comatose conditions) and spinal forms of decompression sickness, pathomorphological studies were also performed. It was established that the main significance should be connected with circulatory disturbances and the peculiarities of vascularization in the pathogenesis of nervous-system lesions. Author (GRA)

N73-10087# Naval Submarine Medical Center, Groton, Conn.

PSYCHOLOGICAL EFFECTS OF PROLONGED EXPOSURE TO SONAR SIGNALS AT AN ELEVATED INTENSITY. 1: FIVE DAYS' EXPOSURE TO SIGNALS AT 85 dB Interim Report

Benjamin B. Weybrew and Ernest M. Noddin 2 Dec. 1971 18 p refs

(AD-744938; NSMRL-689) Avail: NTIS CSCL 06/19

Twelve enlisted submariner candidates were confined to an Audiology Lab for a period of 10 days. Intervening between 2 pre-experimental and 2 recovery days were 5 days: exposure to a continuous sonar signal at 85 dB. Addition test scores declined, letter cancellation accuracy also declined, and the four adjective checklist measures of affect and mod, viz., hostility, depression, anxiety and maladjustive trends, all increased within the first day of the sound exposure. However, these indicators had all reverted to pre-experimental level by 48-60 hours into the sound-on phase of the experiment. On the third day of the sound exposure one of the 12 subjects developed anxiety symptoms acute enough to warrant tranquilizer medication. The self-control design of the study, however, does not allow for any unequivocal statement regarding the cause of these symptoms. Author (GRA)

N73-10088# Naval Submarine Medical Center, Groton, Conn.

THE VISUAL EVOKED CORTICAL RESPONSE AS A MEASURE OF STRESS IN NAVAL ENVIRONMENTS: METHODOLOGY AND ANALYSIS. 2: RAPID FLASH RATES

Jo Ann S. Kinney, Christine L. McKay, A. Mensch, and S. M. Luria 6 Oct. 1971 20 p refs

(AD-744934; NSMRL-681; PR-2) Avail: NTIS CSCL 06/19

The second of two reports is presented whose goal is to evolve methodology for use in evaluating the visual evoked response (VER). The first presented techniques for obtaining and evaluating the complete evoked response; in this study, the method purposely results in VER's which are incomplete, by presenting the visual stimuli at rates that are too rapid to be responded to singly. Rapid flash rates are shown to produce VER's which are reliable and easy to interpret and assess statistically. Furthermore, they appear to be composed of factors in addition to elements from the complete evoked response. Together the methods evolved in the two papers provide efficient techniques for using the VER as a tool in studying Naval problems. Author (GRA)

N73-10089# Naval Aerospace Medical Research Lab., Pensacola, Fla.

RHESUS MONKEY HEART RATE DURING EXERCISE

John DeLorge and John S. Thach, Jr. 18 Apr. 1972 19 p refs

(AD-744930; NAMRL-969) Avail: NTIS CSCL 06/16

Three rhesus monkeys were implanted with ECG telemeters and performed a calisthenic exercise requiring complete arm extension above their heads and below their knees. The animals were unrestrained and confined to a large box. The exercise was programmed to produce food pellets on various reinforcement schedules. Heart rate samples were obtained both during sleep and high rates of activity. Two animals provided exercise data and one animal provided data without the exercise task. Highest heart rates were seen in the two exercise animals. No differences in maximum heart rates were related to the different reinforcement schedules. In most instances heart rates were twice those of resting heart rates for 5 minutes or longer. Occasionally, heart rates were three times the resting rates for at least 2 minutes. The resting heart rates from all three animals were generally lower than those reported in previous literature as normal rates in the rhesus. During the fixed-interval reinforcement schedule there was a correlated increase in heart rate along with the increase in response rate. Author (GRA)

N73-10090# Minnesota Univ., Minneapolis. Chronobiology Labs.
CIRCADIAN RHYTHMS OF THE CIRCULATORY SYSTEM. LITERATURE REVIEW: COMPUTERIZED CASE STUDY OF TRANSMERIDIAN FLIGHT AND MEDICATION EFFECTS ON A MILDLY HYPERTENSIVE SUBJECT Technical Report, 1 Jan. 1969 - 15 Aug. 1971
Howard Levine and Franz Halberg Apr. 1972 72 p refs
(Contract F29600-69-C-0011; AF Proj. 7755)
(AD-743300; SAM-TR-72-3) Avail: NTIS CSCL 06/16

Rhythmic changes in blood pressure are assessed by flight surgeons and other medical practitioners by considering separately the systolic as compared to the diastolic measurements. Predictably recurring pressure changes other than those associated with the heartbeat also have long been known and await exploitation in practice. This report: (1) reviews the literature in the field of circadian circulatory rhythms; (2) specifies causes delaying clinical progress in application of circadian rhythmometry; (3) indicates with an illustrative example how modern computer techniques have started to overcome some of the difficulties encountered in quantifying and interpreting rhythms; and (4) demonstrates effects stemming from intercontinental transmeridian flights upon several circadian rhythms in a mildly hypertensive subject. Author (GRA)

N73-10091# Naval Medical Research Inst., Bethesda, Md.
ACOUSTIC-OPTICAL DETECTION OF DECOMPRESSION SICKNESS IN HAMSTERS Medical Research Progress Report
Wesley D. Ulrich, Benjamin E. Smith, and Richard M. Fine 1 Mar. 1972 24 p refs
(AD-743475; PR-3) Avail: NTIS CSCL 06/19

Severe decompression sickness was produced by explosive decompression in twenty-three of forty-one anesthetized hamsters. Analysis of the post-decompression respiration pattern and untrasonic transmission led to two observations: (1) animals without apnea never demonstrated macroscopic bubbles, and (2) animals which gasped always demonstrated macroscopic bubbles. The ultrasound attenuation generally preceded gasping but did not precede apnea unless more than ten minutes had elapsed since decompression. The respiratory signs were considered to be a consequence of pulmonary aero-embolism. Pilot studies with 2-(4-phenyl-Ipiper-azinylmethyl) cyclohexanone HCL, showed that it decreased mortality in unanesthetized hamsters but increased mortality in animals anesthetized with chloralose-urethane. Pilot studies with piphenhydramine in anesthetized hamsters showed no change in mortality rates. Author (GRA)

N73-10092# Naval Postgraduate School, Monterey, Calif. Dept. of Operations Research and Administrative Sciences.
PARAMETERS AFFECTING UNDERWATER VISION M.S. Thesis
Edward Aberle Ruckner, Jr. Mar. 1972 26 p refs
(AD-743756) Avail: NTIS CSCL 05/10

The purpose of this study was to determine the effects of illumination color, viewing distance, and turbidity on a visual reading task in a totally dark, flooded environment. The reading task was to read a voltmeter and make a correct oral report of the reading. A total of 180 data points spread over 18 viewing conditions were taken for each subject. Seventeen military officers were used as subjects. Experimental conditions were presented in a random manner to all subjects. A statistical examination of the results showed that white or green illumination is better than red in reducing reading response time. Turbidity levels were significant in affecting both increasing as the Attenuation Coefficient increased. Author (GRA)

N73-10093# Naval Weapons Lab., Dahlgren, Va.
BIOLOGICAL HAZARDS FROM EXPOSURE TO ELF ELECTRICAL FIELDS AND POTENTIALS
Herman P. Schwan Mar. 1972 35 p refs
(AD-743480; NWL-TR-2713) Avail: NTIS CSCL 06/18

The report presents a theoretical study of biological hazards arising from exposure to extra low frequency (ELF) electromagnetic environments. It includes an annotated bibliography, the derivation of appropriate mathematical formulae for hazard determination, and presents several recommendations for further studies. The report especially stresses the need for accurate, experimentally verified, measurements of the electrical impedance of the human body in the frequency range of interest. Author (GRA)

N73-10094# Army Medical Research Lab., Fort Knox, Ky.
COLOR NAMING LATENCIES WITH BRIEF EXPOSURES OF INDIVIDUAL STROOP AND CONTROL STIMULI Progress Report
Frederick N. Dyer and Thomas E. Kuehne 13 Mar. 1972 14 p refs
(DA Proj. 3A0-61102-B-71-R)
(AD-745106; USAMRL-970) Avail: NTIS CSCL 05/10

Two experiments utilizing brief presentations of Stroop and control stimuli failed to show any increase in interference to color naming as exposures were shortened. The results contradict Klein's hypothesis that the delay of naming in the Stroop task results from the time required for restimulation by the relevant color unless it is assumed this restimulation can occur via the iconic image. Basically similar results when the iconic image was terminated with an erasure stimulus, further suggest the inappropriateness of the Klein explanation or else of the belief that an iconic image can be terminated in this fashion. The failure to reproduce high interference of a previous study using brief presentations indicates that some other difference between that study and the previous and present works must account for those results. Author (GRA)

N73-10095# Human Engineering Labs., Aberdeen Proving Ground, Md.
REACTION TIME: A BIBLIOGRAPHY WITH ABSTRACTS. SUPPLEMENT 2, WITH SUBJECT INDEX
Lawrence E. Symington Apr. 1972 85 p refs
(AD-745416) Avail: NTIS CSCL 05/10

The bibliography is a 1971 supplement to previous annotated reaction time bibliographies published by the Human Engineering Laboratory. It is a compilation of 232 abstracted references dealing with reaction time in selected human information processing tasks. Most of the references are from the 1971 open literature and are arranged in alphabetical order by author. An alphabetic index of pertinent parameters of investigation is also provided.
Author (GRA)

N73-10096# Oregon State Univ., Corvallis. Dept. of Microbiology.
MICROBIAL ACTIVITIES IN HYPERBARIC ENVIRONMENTS Final Report
P. R. Kenis and R. Y. Morita Jun. 1972 6 p
(Contract N00014-71-C-0190)
(AD-745334) Avail: NTIS CSCL 06/13

High pressure helium-oxygen effects on microbial processes are of interest from the standpoint of spoilage and toxin production in foods; the fouling and degradation of materials stored in the habitat; possible altered pathogenicity of disease causing microorganisms; and to serve as a model system to gain information on high pressure helium-oxygen effects on biochemical processes which may relate to human cells. The present study was limited to a growth response investigation in a high pressure helium-oxygen atmosphere using representative bacteria and yeasts. This information should prove useful to predict gross microbial activity in undersea habitats compared to growth in air at 1 atm. GRA

N73-10097# New Mexico State Univ., University Park. Dept. of Psychology.
PREDICTING HUMAN PERFORMANCE 3: DETECTION OF A SIMPLE VISUAL SIGNAL AS A FUNCTION OF TIME OF WATCH
Warren H. Teichner Jun. 1972 36 p refs
(Contract N00014-70-A-0147-0002; NR Proj. 197-013)
(AD-745317; NMSU-ONR-TR-72-1) Avail: NTIS CSCL 05/10

The percentage of detection of 37 studies of vigilance, using simple signals, were found to depend primarily on the initial or pre-test detection level, the nature of the signal, i.e. whether it is a dynamic signal (requires movement or change of state of the eye) or static, and the duration of the watch. The loss of detection associated with static signals was assumed to be more representative of a loss in a vigilance or attentional process. That loss appears to be rapid in development, essentially complete in about 35 min., and small in amount. The greater decrements

associated with dynamic stimuli were assumed to be due to an additional process of eye fatigue. Author (GRA)

N73-10098# Indiana Univ. Medical Center, Indianapolis.
A STUDY OF THE EFFECTS OF WHOLE-BODY PLUS OR MINUS A(Z) VIBRATION ON POSTURAL SWAY Final Report
J. R. McKay Apr. 1972 25 p refs
(Contract AF 33(615)-2922; AF Proj. 7222)
(AD-745580; AMRL-TR-71-121) Avail: NTIS CSCL 06/19

An experiment is described, the purpose of which was to determine the effects of whole body, plus or minus a(z) vibration on the amplitude and frequencies of postural sway in human subjects. A platform, supported by two force cells and embodying transducers sensitive to applied vertical load, was used to measure the sway of standing subjects. The standard deviation of lateral sway was found to vary between 1.0 and 3.7 lb prior to vibration. Frequency analysis showed that the power lay mainly in the range from 0.01 to 1.0 Hz. Vibration exposure induced small and inconsistent changes in some spectral components of sway and some of these changes were statistically significant. These effects of vibration on sway amplitude and frequency are discussed. Author (GRA)

N73-10099# Twinbrook Research Lab., Rockville, Md.
TWINBROOK RESEARCH LABORATORY Annual Report, 1971
Donald M. Hodge May 1972 262 p refs
(PB-210613) Avail: NTIS HC $3.00 CSCL 06R

Human and animal investigations of both ionizing and nonionizing radiations and their implications on health effects are discussed. GRA

N73-10100# Naval Aerospace Medical Research Lab., Pensacola, Fla.
COMPARATIVE MOTION SICKNESS SYMPTOMATOLOGY AND PERFORMANCE DECREMENTS OCCASIONED BY HURRICANE PENETRATIONS IN C-121, C-130, AND F-3 NAVY AIRCRAFT
Robert S. Kennedy, William F. Moroney, Ronald M. Bale, Harvey G. Gregoire, and David G. Smith 22 Jul. 1971 16 p refs
(AD-743928; NAMRL-1139) Avail: NTIS CSCL 06/19

The purpose of this research was to compare complex monitoring performance and motion sickness symptomatology during hurricane penetration in three types of aircraft. Three different Navy aircraft made six flights, each flight penetrating hurricane Inga several times. The controlling aircraft (a C-121) is routinely employed by the Navy for hurricane penetrations. The other two aircraft (C-130 and P-3) followed the C-121 into the storm at short intervals and penetrated the storm at the same altitude, heading, airspeed, etc. Most subjects experienced slight to moderate malaise during the flights with generally higher sickness rates occurring during the more turbulent flights. The subjects: overall flying experience afforded some protection. Airsickness rates in the C-121 were greater than those in the C-130 and P-3. The results on a complex counting task showed that performance decreased as a function of increased turbulence. Author (GRA)

N73-10101# San Francisco Univ., Calif. Dept. of Physics.
HIGH Z PARTICLE COSMIC-RAY EXPOSURE OF APOLLO 8-14 ASTRONAUTS Technical Report, Nov. 1961 - Dec. 1971
E. V. Benton and R. P. Henke Kirtland AFB, N. Mex. AFWL Jun. 1972 46 p refs
(Contract F29601-70-C-0077; AF Proj. 8803)
(AD-745188; AFWL-TR-72-2) Avail: NTIS CSCL 06/18

On Apollo missions that individual astronauts: high Z particle exposure was measured by means of Lexan foils located in the passive dosimetry packs carried on the chest, thigh, and ankle of each astronaut. The report deals with measurements obtained on Apollo flights 8-14. Data is presented on the high Z track fluences, the stopping particle densities, and the particle integral LET spectra. The LET spectra, in turn, are used to calculate the fractional cell loss, FCL, of the human kidney (TI) cells arising from the high Z particle exposure. The measurements, on subsequent missions, show a consistent and a significant increase in the observed high Z particle exposure. Author (GRA)

N73-10102# Flying Personnel Research Committee, London (England).
THE INCIDENCE OF BACKACHE AMONG AIRCREW AND GROUNDCREW IN THE ROYAL AIR FORCE Technical Report, 1969 - 1970
J. G. Fitzgerald and Jane Crotty Feb. 1972 45 p ref Revised
(AD-745177; FPRC-1313-Rev) Avail: NTIS CSCL 06/5

To determine the incidence of backache in Royal Air Force aircrew a questionnaire-type survey involving two thousand aircrew and groundcrew was carried out in 1969-70. Aircrew showed an incidence significantly higher than that in groundcrew. Among the aircrew group the incidence of backache in pilots was significantly higher than that in navigators and other aircrew combined. Pilots using ejector seats showed a higher incidence than those using static seats; among the latter group helicopter pilots suffer more discomfort than their colleagues using other types of static seats. More than half of the pilots who experience frequent in-flight backache or pain never suffer from backache on the ground. Author (GRA)

N73-10103# Naval Submarine Medical Center, Groton, Conn.
BINAURAL IMPROVEMENT IN NORMAL AND DEFECTIVE EARS IN A BACKGROUND OF OTHER VOICES Medical Research Progress Report
J. Donald Harris and Cecil K. Myers 2 Aug. 1971 17 p refs
(AD-746101; NSMRL-677; Rept-3) Avail: NTIS CSCL 17/2

A realistic artificial head with hi-fi microphones in the positions of eardrums was placed in a large echo-free chamber, looking at a loudspeaker ten feet distant. The loudspeaker presented lists of ten colloquial sentences, while two other loudspeakers at plus or minus 45 deg presented a male and a female voice reading interesting materials. Two-channel magnetic tape recordings were created of this multiple voice situation, at various relative strengths of the background voices. These tapes were administered to one ear, and again to both ears, of 22 normal-hearing young men, and to 22 monaural hypacusics. The monaural mode for the hypacusics was always the better ear. The test is also useful for determining the performance of an individual in certain military multiple-voice listening situations. GRA

N73-10019* Boeing Co., Philadelphia, Pa. Vertol Div.
HELICOPTER CREW/PASSENGER VIBRATION SENSITIVITY
Richard Gabel and Donald A. Reed *In* NASA. Langley Res. Center Symp. on Vehicle Ride Quality Oct. 1972 p 143-153 ref (For availability see N73-10012 01-02)
CSCL 06S

N73-10020* Naval Aerospace Medical Research Lab., Pensacola, Fla.
SOME OF THE MECHANISMS UNDERLYING MOTION SICKNESS
Ashton Graybiel *In* NASA. Langley Res. Center Symp. on Vehicle Ride Quality Oct. 1972 p 155-174 refs (For availability see N73-10012 01-02)
(NASA Order W-13433)
CSCL 06S

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N73-10104*# National Aeronautics and Space Administration, Washington, D.C.
SEVENTH ANNUAL CONFERENCE ON MANUAL CONTROL
1972 354 p refs Conf. held at Los Angeles, 2-4 Jun. 1971
(NASA-SP-281) Avail: NTIS; SOD $3.25 CSCL 05E

Manual control theory and systems are applied to man machine environments. Considered are human operator modeling and display systems in automobile driving, air traffic control, and industrial management. For individual titles, see N73-10105 through N73-10143.

N73-10105* Systems Technology, Inc., Inglewood, Calif.
PROBLEMS IN MODELING MAN MACHINE CONTROL BEHAVIOR IN BIODYNAMIC ENVIRONMENTS
Henry R. Jex *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 3-13 refs (For availability see N73-10104 01-05)
CSCL 05E

Reviewed are some current problems in modeling man-machine control behavior in a biodynamic environment. It is given in two parts: (1) a review of the models which are appropriate for manual control behavior and the added elements necessary to deal with biodynamic interfaces; and (2) a review of some biodynamic interface pilot/vehicle problems which have occurred, been solved, or need to be solved. Author

N73-10106* Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
DEVELOPMENT AND OPTIMIZATION OF A NONLINEAR MULTIPARAMETER MODEL FOR THE HUMAN OPERATOR
Gunnar Johannsen *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 15-21 refs (For availability see N73-10104 01-05)
CSCL 05E

A systematic method is proposed for the development, optimization, and comparison of controller-models for the human operator. This is suitable for any designed model, even multiparameter systems. A random search technique is chosen for the parameter optimization. As valuation criteria for the quality of the model development the criterion function - the comparison between the input and output functions of the human operator and those of the model - and the most important characteristic values and functions of the statistical signal theory are used. A nonlinear multiparameter model for the human operator is being designed which considers the complex input information rate per time in a single display. The nonlinear features of the model are effected by a modified threshold element and a decision algorithm. Different display-configurations as well as various transfer functions of the controlled element are explained by different optimized parameter-combinations. Author

N73-10107* Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
A CONTROL THEORY MODEL FOR HUMAN DECISION MAKING
William H. Levison *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 23-32 refs (For availability see N73-10104 01-05)
(Contract NAS2-5884)
CSCL 05E

The optimal control model for pilot-vehicle systems has been extended to handle certain types of human decision tasks. The model for decision making incorporates the observation noise, optimal estimation, and prediction concepts that form the basis of the model for control behavior. Experiments are described for the following task situations: (1) single decision tasks; (2) two decision tasks; and (3) simultaneous manual control and decision tasks. Using fixed values for model parameters, single-task and two-task decision performance scores to within an accuracy of 10 percent can be predicted. The experiment on simultaneous control and decision indicates the presence of task interference in this situation, but the results are not adequate to allow a conclusive test of the predictive capability of the model.
Author

N73-10108* Naval Ship Research and Development Center, Washington, D.C.
AN INPUT ADAPTIVE, PURSUIT TRACKING MODEL OF THE HUMAN OPERATOR
John R. Ware *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 33-45 refs (For availability see N73-10104 01-05)
(Contracts NSR-23-005-906; NSR-23-005-364)
CSCL 05E

Developed and evaluated is a simple model of the input adaptive behavior of the human operator (HO) in a pursuit tracking is assumed that the HO is approximately an optimal predictor using only position and velocity information, then there is a simple method of computing the values of the model parameters in terms of the autocorrelation function of the input signal. Experimental evidence indicates that the ability of the HO to use velocity information decreases with increasing signal velocity indicating that a biased estimator of the velocity weighting should be used. A suitable approximation is derived which has rapid convergence and low variance. The model thus derived is compared to actual subject transfer functions and is found to be in close agreement. In addition to tracking random processes the model can adapt to and track deterministic signals, such as sine waves, up to approximately the frequency at which human operators begin to track precognitively. Author

N73-10109* Oakland Univ., Rochester, Mich.
A HYBRID COMPUTER PROGRAM FOR THE VISUAL DISPLAY OF COMPENSATORY SYSTEM MODEL PARAMETERS
Glenn A. Jackson and Gerald Brabant *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 47-51 refs (For availability see N73-10104 01-05)
(Grant NGR-23-054-003)
CSCL 05E

A hybrid computer identification program has been developed which determines and displays those parameter values of a model of the compensatory control system that existed over the last fifteen seconds of operation. These values are up-dated every 0.05 sec so that a visual display of the parameters appears to be continuous. Presently, a closed loop crossover model is being used as the compensatory system model with the parameters K and tau displayed, however, any suitable model could be used in its place. Author

N73-10110* Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
INPUT NOISE APPROXIMATION IN TRACKER MODELING M.S. Thesis
Paul F. Torrey and Russell A. Hannen *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 53-55 refs (For availability see N73-10104 01-05)
CSCL 05E

The validity of approximating random Gaussian distributed inputs used in human response modeling by sums of discrete sine waves is studied. An ideal rectangular power density spectrum is simulated using both filtered Gaussian white noise and sums-of-discrete sine waves with three different input cutoff frequencies in the same compensatory tracking task. Resulting normalized tracking error and quality operator observations are used to investigate apparent discrepancies in human operator characteristics. Results show that discrete and continuous input tracking data compare favorable when the power in the crossover region is taken into account. Author

N73-10111* City Coll. of the City of New York.
DIGITAL MODELING OF HUMAN OPERATOR DYNAMICS VIA CLASS OF LIAPUNOV FUNCTIONS
Ralph Mekel and Patrick Peruo, Jr. *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 57-58 (For availability see N73-10104 01-05)
(Grant NGR-33-013-053)
CSCL 05E

A technique is described which is utilized for modeling human operator dynamics. The technique is based upon a model-reference system configuration and a class of Liapunov functions formulated for this purpose which possess variable characteristics. It is shown how such a class of Liapunov functions and their time derivatives is formulated. The crux of the formulation lies in three variable positive definite matrices used for the construction of the class of Liapunov functions. The form and order of these matrices depend upon the form and order of the error differential equation of the human operator model-reference system. These matrices can be modified to include nonlinear functions of the human operator model. Author

N73-10112* Massachusetts Inst. of Tech., Cambridge.
CONSIDERATIONS FOR THE DESIGN OF AN ONBOARD

R. E. Anderson, R. E. Curry, H. G. Weiss, R. W. Simpson, M. E. Connelly, and T. Imrich *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 61-72 refs (For availability see N73-10104 01-05)
CSCL 05E

The basic concept of remoting information to the cockpit is used to design and develop a computerized airborne traffic situation display device that automatically selects and presents segments of a controller's scope to the aircraft pilot via a narrow band digital data link. These data are integrated with aircraft heading and navigation information to provide a display useful in congested air space. The display can include alphanumerical symbols, air route maps, and controller instructions. G.G.

N73-10113* Systems Technology, Inc., Inglewood, Calif.
MANUAL CONTROL THEORY APPLIED TO AIR TRAFFIC CONTROLLER-PILOT COOPERATION
Dunstan Graham, Warren F. Clement, and Lee Gregor Hofmann *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 73-80 refs (For availability see N73-10104 01-05)
CSCL 05E

Reduced runway separation standards are among the means which have been proposed for increasing airport capacity. The probability of a blunder will dominate the calculation of safe separation standards. Then the determinant of safe system performance will be the system reaction time comprised of the air traffic controller's detection, decision and communication delays, and the response times of the pilot and aircraft in executing a collision avoidance manuever. Estimates of these times, based on existing data, show that the delays ascribable to the human portions of the man-machine system are comparatively unimportant. New developments in radar, computers, and data links will be required to provide any substantial improvement of the existing system, and the goal of 2500 ft of separation may not be achievable. Author

N73-10114* Massachusetts Inst. of Tech., Cambridge.
SUPERVISORY SAMPLING AND CONTROL: SOURCES OF SUBOPTIMALITY IN A PREDICTION TASK
Thomas B. Sheridan and William B. Rouse *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 81-88 refs (For availability see N73-10104 01-05)
CSCL 05E

A process supervisor is defined as a person who decides when to sample the process input and what values of a control variable to specify in order to maximize (minimize) a given value function of input sampling period, control setting, and process state. Presented experimental data in such a process where the value function is a time-averaged sampling cost plus mean squared difference between input and control variable. The task was unpaced prediction of the output of a second order filter driven by white noise. Experimental results, when compared to the optical strategy, reveal several consistently suboptimal behaviors. One is a tendency not to choose a long prediction interval even though the optimal strategy dictates that one should. Some results are also interpreted in terms of those input parameters according to which each subjects' behavior would have been nearest optimal. Differences of those parameters from actual input parameters served to quantify how subjects' prediction behavior differed from optimal. Author

N73-10115* California Univ., Los Angeles.
MANUAL CONTROL MODELS OF INDUSTRIAL MANAGEMENT
E. R. F. W. Crossman *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 89-100 refs (For availability see N73-10104 01-05)
(Contract N00014-69-A-0200-1043)
CSCL 05E

The industrial engineer is often required to design and implement control systems and organization for manufacturing and service facilities, to optimize quality, delivery, and yield, and minimize cost. Despite progress in computer science most such systems still employ human operators and managers as real-time control elements. Manual control theory should therefore be applicable to at least some aspects of industrial system design and operations. Formulation of adequate model structures is an essential prerequisite to progress in this area; since real-world production systems invariably include multilevel and multiloop control, and are implemented by timeshared human effort. A modular structure incorporating certain new types of functional element, has been developed. This forms the basis for analysis of an industrial process operation. In this case it appears that managerial controllers operate in a discrete predictive mode based on fast time modelling, with sampling interval related to plant dynamics. Successive aggregation causes reduced response bandwidth and hence increased sampling interval as a function of level. Author

N73-10116* Oakland Univ., Rochester, Mich.
A DYNAMIC MODEL OF THE HUMAN POSTURAL CONTROL SYSTEM
J. C. Hill *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 103-113 ref (For availability see N73-10104 01-05)
(Grant NGR-23-054-033)
CSCL 05E

A digital simulation of the pitch axis dynamics of a stick man of figures is described. Difficulties encountered in linearizing the equations of motion are discussed; the conclusion reached is that a completely linear simulation is of such restricted validity that only a nonlinear simulation is of any practical use. Typical simulation results obtained from the full nonlinear model are presented. Author

N73-10117* Illinois Univ., Chicago.
FURTHER OBSERVATIONS ON THE RELATIONSHIP OF EMG AND MUSCLE FORCE
Gyan C. Agarwal, Lawrence R. Cecchini, and Gerald L. Gottlieb *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 115-118 refs (For availability see N73-10104 01-05)
(Grant NSF GK-17581)
CSCL 05E

Human skeletal muscle may be regarded as an electromechanical transducer. Its physiological input is a neural signal originating at the alpha motoneurons in the spinal cord and its output is force and muscle contraction, these both being dependent on the external load. Some experimental data taken during voluntary efforts around the ankle joint and by direct electrical stimulation of the nerve are described. Some of these experiments are simulated by an analog model, the input of which is recorded physiological soleus muscle EMG. The output is simulated foot torque. Limitations of a linear model and effect of some nonlinearities are discussed. Author

N73-10118* Michigan Univ., Ann Arbor.
THE USE OF A BATTERY OF TRACKING TESTS IN THE QUANTITATIVE EVALUATION OF NEUROLOGICAL FUNCTION
B. S. Repa, J. W. Albers, A. R. Potvin, and W. W. Tourtellotte *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 119-128 refs (For availability see N73-10104 01-05)
(Contract NSR-23-005-364; Grant GM-01289-07)
CSCL 05E

A tracking test battery has been applied in a drug trail designed to compare the efficacy of L-DOPA and amantadine to that of L-DOPA and placebo in the treatment of 28 patients with Parkinson's disease. The drug trial provided an ideal opportunity for objectively evaluating the usefulness of tracking tests in assessing changes in neurologic function. Evaluating changes in patient performance resulting from disease progression and controlled clinical trials is of great importance in establishing effective treatment programs. Author

N73-10119* Massachusetts Inst. of Tech., Cambridge.
HUMAN DISORIENTATION IN A ROTATING SPACECRAFT
Laurence R. Young *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 125-128 refs (For availability see N73-10104 01-05)
(Grants NGR-22-009-025; NGR-22-009-156)
CSCL 05E

The problem of disorientation in a rotating spacecraft is treated as an example of the general case of habituation to an unusual motion environment using all sensors and active movements. The dynamic response of the sensors is stressed. Several avenues for work on combating disorientation are mentioned. Author

N73-10120* Technische Univ., Berlin (West Germany). Inst. fuer Flugfuehrung und Luftverkehr.
THE INFLUENCE OF A PREDICTION DISPLAY ON THE QUASI-LINEAR DESCRIBING FUNCTION AND REMNANT MEASURED WITH AN ADAPTIVE ANALOG-PILOT IN A CLOSED LOOP
D. Dey *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 131-135 refs (For availability see N73-10104 01-05)
CSCL 05E

The effect of a prediction display on the human transfer characteristics is explained with the aid of a quasi-linear model. The prediction display causes an increase of the gain factor and the lead factor, a diminishing of the lag factor and a decrease of the remnant. Altogether, these factors yield a smaller mean square value of the control deviation and a simultaneous decrease of the mean square value of the stick signal. Author

N73-10121* Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
ANALYTIC EVALUATION OF DISPLAY REQUIREMENTS FOR APPROACH TO LANDING
David L. Kleinman and Sheldon Baron *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 137-138 refs Submitted for publication (For availability see N73-10104 01-05)
CSCL 05E

A pilot-vehicle-display model is used to study information and display requirements and the effects on system performance and reliability of pilot-induced randomness, wind gusts, configurational changes, etc. A brief description of a control theoretic systems model is given and its use and validity are demonstrated by applying it in a piloted approach to landing situation. The analysis procedure assumes that the vehicle dynamics are represented by linearized equations of motion. Author

N73-10122* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PILOT PERFORMANCE WITH A SIMULATED ILS INDEPENDENCE PICTORIAL DISPLAY
Everett Palmer and Thomas Wempe *In its* 7th Ann. Conf. on Manual Control 1972 p 139-154 refs (For availability see N73-10104 01-05)
CSCL 05E

As part of a general investigation of the effectiveness of pictorial displays for manual control and monitoring of aircraft approaches and landings, a simulator study was conducted in which pilot performance with three pictorial displays was evaluated. These displays differed in the type of guidance symbology added to the basic perspective runway display. The effect of decreased resolution and update rate of the runway image on pilot performance was also determined. The results indicate that for pictorial displays with added guidance symbology, there was a marked improvement in pilot performance compared to results of a previous study in which the display consisted of only a runway image and aircraft attitude. Author

N73-10123* Systems Technology, Inc., Inglewood, Calif.
EFFECTS OF DISPLAY FORMAT ON PILOT DESCRIBING FUNCTION AND REMNANT
Henry R. Jex, R. Wade Allen, and R. E. Magdaleno *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 155-159 ref (For availability see N73-10104 01-05)
(Contract F33615-69-C-1808)
CSCL 05E

As part of a program to develop a comprehensive theory of manual control displays, six display formats were used by three instrument-rated pilots to regulate against random disturbances with a controlled element under both foveal and 10 deg parafoveal viewing conditions. The six display formats were: CRT line, CRT thermometer bar, 14-bar quantized on a CRT, a rotary dial and pointer, and two variations of a moving scale tape-drive. All were scaled to equivalent movement and apparent brightness. Measures included overall performance, describing functions, error remnant power spectra, critical instability scores, and subjective display ratings. The results show that the main effect of display format is on the loop closure properties. Less desirable displays induce lower bandwidth closures with consequent effects on the closed-loop remnant and performance. Author

N73-10124* Systems Technology, Inc., Inglewood, Calif.
A DYNAMIC RESPONSE AND EYE SCANNING DATA BASE USEFUL IN THE DEVELOPMENT OF THEORIES AND METHODS FOR THE DESCRIPTION OF CONTROL/DISPLAY RELATIONSHIPS
Richard Klein *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 161-166 refs (For availability see N73-10104 01-05)
(Contract NAS2-5690)
CSCL 05E

A set of specially prepared digital tapes is reported which contain synchronized measurements of pilot scanning behavior, control response, and vehicle response obtained during instrument landing system approaches made in a fixed-base DC-8 transport simulator. The objective of the master tape is to provide a common data base which can be used by the research community to test theories, models, and methods for describing and analyzing control/display relations and interactions. The experimental conditions and tasks used to obtain the data and the detailed format of the tapes are described. Conventional instrument panel and controls were used, with simulated vertical gust and glide slope beam bend forcing functions. Continuous pilot eye fixations and scan traffic on the panel were measured. Both flight director and standard localizer/glide slope types of approaches were made, with both fixed and variable instrument range sensitivities. Author

N73-10125* Douglas Aircraft Co., Inc., Santa Monica, Calif.
CONTROL INFORMATION IN VISUAL FLIGHT
J. M. Naish *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 167-176 refs (For availability see N73-10104 01-05)
CSCL 05E

The purpose of the inquiry is to determine how precisely a pilot can estimate the movements of his vehicle, and thus exercise control, during an unaided visual approach. The method is to relate changes in the forward view. due to movements along and across the approach path, to human visual thresholds and errors. The scope is restricted to effects of inclination, expansion, size, and rotation in runway features during approaches at small angles of elevation. Quantitative relations are given which provide a basis for ranking the several information mechanisms. Alignment by inclination of a ground line is found to be an accurate lateral mechanism, probably superior to the expansion mechanism. Vertical control mechanisms are complex, of questionable accuracy, and difficult to rank. The results throw some doubt on the usefulness of a runway symbol as a source of displayed information. Author

N73-10126* Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
ON THE DEPENDENCE OF INFORMATION DISPLAY QUALITY REQUIREMENTS UPON HUMAN CHARACTERISTICS AND PILOT/AUTOMATICS RELATIONS
V. Wilckens *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 177-183 refs (For availability see N73-10104 01-05)
CSCL 05E

Present information display concepts for pilot landing guidance are outlined considering manual control as well as substitution of man by fully competent automatics. Display improvements are achieved by compressing the distributed indicators into an accumulative display and thus reducing information scanning. Complete integration of quantitative indications, outer loop information, and real world display in a pictorial information channel geometry constitutes an interface with human ability to differentiate and integrate for optimal manual control of the aircraft. G.G.

N73-10127* Massachusetts Inst. of Tech., Cambridge.
A BAYESIAN MODEL FOR VISUAL SPACE PERCEPTION
Renwick E. Curry *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 187-196 refs (For availability see N73-10104 01-05)
CSCL 05E

A model for visual space perception is proposed that contains desirable features in the theories of Gibson and Brunswik. This model is a Bayesian processor of proximal stimuli which contains

three important elements: an internal model of the Markov process describing the knowledge of the distal world, the a priori distribution of the state of the Markov process, and an internal model relating state to proximal stimuli. The universality of the model is discussed and it is compared with signal detection theory models. Experimental results of Kinchla are used as a special case. Author

N73-10128* Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
A PROPOSAL FOR PREPROCESSING, REDUCTION, AND SELECTION OF VISUAL INFORMATION IN AIRBORNE FLIGHT SIMULATION
K.-P. Gaertner *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 197-199 refs (For availability see N73-10104 01-05)
CSCL 05E

A noncritical empirical detail-by-detail transformation of environmental information into flight display by purely physical methods characterizes the textured visual simulation as indiscernibly identical with the real scene. This method uses image storage, readout, image transformation, and graphic display to present a true color visual flight image to the pilot onboard aircraft in a purely electronic manner, employing analog-hybrid techniques. G.G.

N73-10129* Michigan Univ., Ann Arbor.
MAPPING AN OPERATOR'S PERCEPTION OF A PARAMETER SPACE
Richard W. Pew and Richard J. Jagacinski *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 201-206 refs Sponsored in part by NSF (For availability see N73-10104 01-05)
(Contract NSR-23-005-364)
CSCL 05E

Operators monitored the output of two versions of the crossover model having a common random input. Their task was to make discrete, real-time adjustments of the parameters k and tau of one of the models to make its output time history converge to that of the other, fixed model. A plot was obtained of the direction of parameter change as a function of position in the (tau, k) parameter space relative to the nominal value. The plot has a great deal of structure and serves as one form of representation of the operator's perception of the parameter space. Author

N73-10130* Systems Technology, Inc., Inglewood, Calif.
THE MEASUREMENT OF DRIVER DESCRIBING FUNCTIONS IN SIMULATED STEERING CONTROL TASKS
David H. Weir and Charles K. Wojcik (Calif. Univ.) *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 209-218 refs Sponsored in part by Calif. Bus. and Transp. Agency and the Bur. of Public Roads (For availability see N73-10104 01-05)
CSCL 05E

Measurements of driver describing functions in steering control tasks have been made using a driving simulator. The task was to regulate against a random crosswind gust input on a straight roadway, in order to stay in the center of the lane. Although driving is a multiloop task in general, the forcing function and situation were configured so that an inner-loop visual cue feedback of heading angle of heading rate would dominate, and the driver's response was interpreted to be primarily single-loop. The driver describing functions were measured using an STI describing function analyzer. Three replications for each subject showed good repeatability within a subject. There were some intersubject differences as expected, but the crossover frequencies, effective time delays, and stability margins were generally consistent with the prior data and models for similar manual control tasks. The results further confirm the feasibility of measuring human operator response properties in nominal control tasks with full (real-world) visual field displays. Author

N73-10131* Wright State Univ., Dayton, Ohio.
SOME INTERACTIONS AMONG DRIVER, VEHICLE, AND ROADWAY VARIABLES IN NORMAL DRIVING
Malcolm L. Ritchie, John M. Howard, and W. David Myers *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 219-222 refs (For availability see N73-10104 01-05)
CSCL 05E

Effects of road and vehicle conditions, visual warning signs, direction of turns, night time, and skill on automobile driver performance are studied in several experiments. Considered criteria are variability in speed and acceleration. G.G.

N73-10132* California Univ., Berkeley.
ESTIMATION OF AUTOMOBILE-DRIVER DESCRIBING FUNCTION FROM HIGHWAY TESTS USING THE DOUBLE STEERING WHEEL
P. Delp, E. R. F. W. Crossman, and H. Szostak *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 223-236 refs (For availability see N73-10104 01-05)
(Grant AC-00260-02)
CSCL 05E

The automobile-driver describing function for lateral position control was estimated for three subjects from frequency response analysis of straight road test results. The measurement procedure employed an instrumented full size sedan with known steering response characteristics, and equipped with a lateral lane position measuring device based on video detection of white stripe lane markings. Forcing functions were inserted through a servo driven double steering wheel coupling the driver to the steering system proper. Random appearing, Gaussian, and transient time functions were used. The quasi-linear models fitted to the random appearing input frequency response characterized the driver as compensating for lateral position error in a proportional, derivative, and integral manner. Similar parameters were fitted to the Gabor transformed frequency response of the driver to transient functions. A fourth term corresponding to response to lateral acceleration was determined by matching the time response histories of the model to the experimental results. The time histories show evidence of pulse-like nonlinear behavior during extended response to step transients which appear as high frequency remnant power. Author

N73-10133* Systems Technology, Inc., Inglewood, Calif.
VISUAL MOTOR RESPONSE OF CREWMEN DURING A SIMULATED 90 DAY SPACE MISSION AS MEASURED BY THE CRITICAL TASK BATTERY
Wade Allen and Henry R. Jex *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 239-246 refs (For availability see N73-10104 01-05)
(Contract NAS2-4405)
CSCL 05E

In order to test various components of a regenerative life support system and to obtain data on the physiological and psychological effects of long-duration exposure to confinement in a space station atmosphere, four carefully screened young men were sealed in space station simulator for 90 days. A tracking test battery was administered during the above experiment. The battery included a clinical test (critical instability task) related to the subject's dynamic time delay, and a conventional steady tracking task, during which dynamic response (describing functions) and performance measures were obtained. Good correlation was noted between the clinical critical instability scores and more detailed tracking parameters such as dynamic time delay and gain-crossover frequency. The comprehensive data base on human operator tracking behavior obtained in this study demonstrate that sophisticated visual-motor response properties can be efficiently and reliably measured over extended periods of time. Author

N73-10134* Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
PREDICTION AND ANALYSIS OF HUMAN PERFORMANCE IN A VTOL HOVER TASK
Sheldon Baron and David L. Kleinman *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 247-256 refs (For availability see N73-10104 01-05)
(Contract NAS12-104)
CSCL 05E

An optimal control model is used to predict pilot performance in a series of longitudinal hovering tasks. Configurational changes are considered that alter significantly the system response to both control and disturbance inputs. Model predictions of mean-squared performance are compared with measurements obtained in an independent experimental study of the task. In

addition, the optimal control model is used to predict describing functions that correspond to the loop closing pilot transfer functions frequently employed in classical multiloop manual control analyses. Author

N73-10135* Princeton Univ., N.J.
A PERFORMANCE MEASURE FOR MANUAL CONTROL SYSTEMS
Theodor A. Dukes and Pershing B. Sun *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 257-263 refs (For availability see N73-10104 01-05)
(Contract DA-28-043-AMC-02412(E))
CSCL 05E

A new performance measure is introduced for multivariable closed loop experiments with a human operator. The essential feature of the phase margin performance measure (PMPM) is that the performance of each control loop can be determined independently, with prescribed disturbance and error levels. A variable filter parameter is used as the PMPM within the loop and it assures a high workload at the same time. There is a straightforward relationship between the PMPM and the inner loop feedback augmentation that can be utilized in trade-off studies. An adjustment scheme that seeks the PMPM automatically is described as employed in a single loop control task. This task applies directly to the experimental study of displays for helicopters and VTOL aircraft. Author

N73-10136* Systems Technology, Inc., Inglewood, Calif.
SERIAL SEGMENT METHOD FOR MEASURING REMNANT
R. E. Magdaleno *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 265-269 refs (For availability see N73-10104 01-05)
CSCL 05E

For tracking tasks where a sum of sine waves forcing function is used it is often difficult and/or expensive to obtain the pilot's remnant in the vicinity of the sine waves. For the case where each sine wave has at least four times an integer number of cycle per run length, this paper illustrates the serial segments method for measuring remnant power spectral density in a frequency band centered on each sine wave. This method can be implemented on digital, hybrid, or analog Fourier coefficient analyzers, and is particularly advantageous on the latter since properties of Fourier coefficients are exploited to yield both a remnant measure and an improved estimate of the correlated component. Author

N73-10137* Honeywell Inc., Minneapolis, Minn.
A DESIGN PROCEDURE AND HANDLING QUALITY CRITERIA FOR LATERAL DIRECTIONAL FLIGHT CONTROL SYSTEMS
G. Stein and A. H. Henke *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 271-284 refs (For availability see N73-10104 01-05)
(Contract F33615-70-C-1190)
CSCL 05E

A practical design procedure for aircraft augmentation systems is described based on quadratic optimal control technology and handling-quality-oriented cost functionals. The procedure is applied to the design of a lateral-directional control system for the F4C aircraft. The design criteria, design procedure, and final control system are validated with a program of formal pilot evaluation experiments. Author

N73-10138* Air Force Systems Command, Wright-Patterson AFB, Ohio.
APPLICATION OF MANUAL CONTROL THEORY TO THE STUDY OF BIOLOGICAL STRESS
Clyde R. Repogle, Frank M. Holden, and Carroll N. Iay *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 285-289 ref (For availability see N73-10104 01-05)
CSCL 05E

A study was run using both a stable, third-order task and an adaptive first-order unstable task singly and in combination to test the effects of 2 min hypoxia (22000 ft) on human operator. The results indicate that the RMS error in the stable task does not change as a function of hypoxic stress whereas the error in an unstable task changes significantly. Models involving human operator parameter changes and noise injection are discussed. Author

N73-10139* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HUMAN TRANSINFORMATION RATES DURING ONE-TO-FOUR AXIS TRACKING WITH A CONCURRENT AUDIO TASK
Daniel L. Baty *In its* 7th Ann. Conf. on Manual Control 1972 p 293-306 refs (For availability see N73-10104 01-05)
CSCL 05E

The information processing rates of six subjects performing one-, two-, three-, and four-axis compensatory tracking tasks, with and without a concurrent four-choice auditory task were determined. The purpose was to obtain further evidence concerning the nature of an hypothesized ceiling on human transinformation rates. Interference was found among tasks, but the evidence concerning a ceiling on information processing rates was inconclusive. Author

N73-10140* California Univ., Los Angeles.
THE EFFECTS OF ATTENTION SHARING IN A DYNAMIC DUAL TASK ENVIRONMENT
R. C. Cliff *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 307-325 refs (For availability see N73-10104 01-05)
CSCL 05E

There are numerous examples of cases where the human operator is confronted with several tasks occurring simultaneously and continuously in time. The current study is an investigation into the nature of attention sharing between two continuous tasks with independent input-output modes. Eleven subjects were tested using a zero order compensatory control task with three levels of difficulty (input bandwidth) for each subject. As a secondary task on half of the trials, the subjects were also required to verbally shadow a random auditory input. Results from an extensive time and frequency domain analysis of the data are presented and discussed. The evidence supports a single channel model for continuous dual-task control. Author

N73-10141* Systems Technology, Inc., Inglewood, Calif.
MOTION CUE EFFECTS ON PILOT TRACKING
Robert F. Ringland and Robert L. Stapleford *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 327-338 refs (For availability see N73-10104 01-05)
(Contracts NAS2-3650; NAS2-5261)
CSCL 05E

The results of two successive experimental investigations of the effects of motion cues on manual control tracking tasks are reported. The first of these was an IFR single-axis VTOL roll attitude control task. Describing function data show the dominant motion feedback quantity to be angular velocity. The second experimental task was multiaxis, that of precision hovering of a VTOL using separated instrument displays with reduced motion amplitude scaling. Performance data and pilot opinion show angular position to be the dominant cue when simulator linear motion is absent. Author

N73-10142* Connecticut Univ., Storrs.
HUMAN OPERATOR DYNAMICS FOR AURAL COMPENSATORY TRACKING
Edward W. Vinje (United Aircraft Res. Labs.) and Edward T. Pitkin *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 339-348 refs (For availability see N73-10104 01-05)
CSCL 05E

The human operator's ability to control using aural information only and using combined aural and visual displays was investigated for a simple tracking task. Tracking error was presented to the test subjects using one- and two-ear displays. For both displays the pitch of the tone represented the magnitude of the tracking error. The operator's aural control characteristics were modeled as a describing function plus a remnant. The effects on the measured describing function and remnant of different system dynamics, changes in the frequency content of the input and different displays were determined during the study. The describing function and remnant data indicate that humans can control as well with aural cues as with visual cues for the task considered. However, the reduction in operator time delays, expected because

of the generally faster human response to aural stimuli, was not evident in the results. It was also determined that the operators could control equally well with either the one- or two-ear display. Author

N73-10143* Stanford Research Inst., Calif.
A COMPUTER ASSISTED TELEOPERATOR CONTROL STATION WITH TACTILE FEEDBACK
J. W. Hill and J. C. Bliss *In* NASA, Washington 7th Ann. Conf. on Manual Control 1972 p 349-361 refs (For availability see N73-10104 01-05)
(Contract NAS2-5409)
CSCL 05E

A computer-assisted teleoperator control system for making comparative performance evaluations is described. A local and a remote control station, each with decision-making capability, communicate with each other through a simulated time delay. Supervisory control at three increasingly automatic levels is possible. The highest level of programmed control is facilitated through the ARM language which was developed to permit easily readable program manuscripts to be written and assembled into programs of motions by novice programmers. Experimental results show the advantage of this form of supervisory control with both direct and delayed (3 sec) manipulation tasks. In addition, two systems to measure and reproduce force distributions have been designed. One system reproduces contact on the external surfaces of the remote hand using 21 airjet simulators. Another system reproduces the shape of the contact between object and jaws using 288 piezoelectric (bimorph) stimulators. Author

N73-10144# Joint Publications Research Service, Arlington, Va.
PROCESSING OF MEDICAL INFORMATION AND ASSESSMENT OF WORK CAPACITY IN SPACE FLIGHT
2 Nov. 1972 23 p refs Transl. into ENGLISH from Kosm. Issled (Moscow), no. 4, 1972 p 614-619
(JPRS-57417) Avail: NTIS HC $3.25

Articles, analyzing the motor efficiency of a cosmonaut in flight and the use of sample quantiles to condense, telemeter, and statistically process medical information are presented. Author

N73-10145*# Autonetics, Anaheim, Calif.
ANALYSIS OF A DISPLAY AND CONTROL SYSTEM MAN-MACHINE INTERFACE CONCEPT. VOLUME 1: FINAL TECHNICAL REPORT
D. R. Karl 8 Sep. 1972 214 p refs
(Contract NAS9-12266)
(NASA-CR-128576; C71-999/401-Vol-1) Avail: NTIS HC $12.75 CSCL 05E

An evaluation was made of the feasibility of utilizing a simplified man machine interface concept to manage and control a complex space system involving multiple redundant computers that control multiple redundant subsystems. The concept involves the use of a CRT for display and a simple keyboard for control, with a tree-type control logic for accessing and controlling mission, systems, and subsystem elements. The concept was evaluated in terms of the Phase B space shuttle orbiter, to utilize the wide scope of data management and subsystem control inherent in the central data management subsystem provided by the Phase B design philosophy. Results of these investigations are reported in four volumes. Author

N73-10146*# Autonetics, Anaheim, Calif.
ANALYSIS OF A DISPLAY AND CONTROL SYSTEM MAN-MACHINE INTERFACE CONCEPT. VOLUME 2: APPENDICES A AND B Final Report
D. R. Karl 8 Sep. 1972 152 p
(Contract NAS9-12266)
(NASA-CR-128577; C71-999/401-Vol-2) Avail: NTIS HC $9.75 CSCL 05E
For abstract, see N73-10145.

N73-10147*# Autonetics, Anaheim, Calif.
ANALYSIS OF A DISPLAY AND CONTROL SYSTEM MAN-MACHINE INTERFACE CONCEPT. VOLUME 3: APPENDICES C, D AND E Final Report
D. R. Karl 8 Sep. 1972 93 p
(Contract NAS9-12266)
(NASA-CR-128578; C71-999/401-Vol-3) Avail: NTIS HC $6.75 CSCL 05E
For abstract, see N73-10145

N73-10148*# Autonetics, Anaheim, Calif.
ANALYSIS OF A DISPLAY AND CONTROL SYSTEM MAN-MACHINE INTERFACE CONCEPT. VOLUME 4: APPENDIX F Final Report
D. R. Karl 8 Sep. 1972 78 p
(Contract NAS9-12266)
(NASA-CR-128579; C71-999/401-Vol-4) Avail: NTIS HC $6.00 CSCL 05E
For abstract, see N73-10145.

N73-10149*# Fairchild Republic Div., Farmingdale, N.Y.
SPACECRAFT SANITATION AGENT DEVELOPMENT Final Report
18 Aug. 1972 74 p
(Contract NAS9-12205)
(NASA-CR-128591; MS142Y0004) Avail: NTIS HC$5.75 CSCL 06I

The development of an effective sanitizing agent that is compatible with the spacecraft environment and the human occupant is discussed. Experimental results show that two sanitation agents must be used to satisfy mission requirements: one agent for personal hygiene and one for equipment maintenance. It was also recommended that a water rinse be used with the agents for best results, and that consideration be given to using the agents pressure packed or in aerosol formulations. E.H.W.

N73-10150*# URS/Matrix Co., Essex, Md. Life and Environmental Sciences Div.
STUDY OF ASTRONAUT RESTRAINTS AND MOBILITY AIDS IN A WEIGHTLESS SHIRTSLEEVE ENVIRONMENT
Harry L. Loats, Jr. and G. Samuel Mattingly 27 Sep. 1972 73 p
(Contract NAS9-12574)
(NASA-CR-128590; PRL-339) Avail: NTIS HC $5.75 CSCL 06K

A study, established to produce needed information about manual performance limits in intravehicular weightlessness such as the motions induced by the astronaut's direct application of force against the body of the vehicle or an object to be moved, is presented. Using both conventional and water immersion techniques, it was possible to develop realistic time estimates for astronaut station-to-station translation in Skylab, to simulate and analyze specific Skylab tasks involving force application and motion dynamics, and to evaluate certain thresholds of force application in weightlessness. The study was divided into three tasks. The first related to locomotion and verification or modification of present Skylab translation timelines. In all cases, translation times were less than the Skylab timelines indicated. The second task studied mass handling and transfer. Specifically, this involved measurement of the astronaut's ability to relocate the Skylab food lockers to stowage levels of three different heights and his ability to transfer the M509 PSS bottles between the OWS and the recharge station. The third task helped define the physical limits of man's ability to perform Skylab translation tasks under weightless conditions. Author

N73-10151*# General Electric Co., Philadelphia, Pa. Reentry and Environmental Systems Div.
EXPERIMENTS EVALUATING COMPLIANCE AND FORCE FEEDBACK EFFECT ON MANIPULATOR PERFORMANCE Final Report
D. A. Kugath 25 Aug. 1972 66 p
(Contract NAS9-12536)
(NASA-CR-128605; DOC-72CAMSS100; MSC-07239) Avail: NTIS HC $5.50 CSCL 05E

The performance capability was assessed of operators performing simulated space tasks using manipulator systems which had compliance and force feedback varied. Two manipulators were used, the E-2 electromechanical man-equivalent (force, reach, etc.) master-slave system and a modified CAM 1400 hydraulic master-slave with 100 lbs force capability at reaches of 24 ft. The CAM 1400 was further modified to operate without its

normal force feedback. Several experiments and simulations were performed. The first two involved the E-2 absorbing the energy of a moving mass and secondly, guiding a mass thru a maze. Thus, both work and self paced tasks were studied as servo compliance was varied. Three simulations were run with the E-2 mounted on the CAM 1400 to evaluate the concept of a dexterous manipulator as an end effector of a boom-manipulator. Finally, the CAM 1400 performed a maze test and also simulated the capture of a large mass as the servo compliance was varied and with force feedback included and removed.
Author

N73-10152*# Boeing Co., Seattle, Wash.
DEGRADATION OF LEARNED SKILLS. A REVIEW AND ANNOTATED BIBLIOGRAPHY
Gene R. Gardlin and Thomas E. Sitterely Jun. 1972 125 p refs
(Contract NAS9-10962)
(NASA-CR-128611; D180-15080-1) Avail: NTIS HC $8.25 CSCL 05E

An overview of the literature dealing with the retention of learned skills is presented. Basic effects of task type, training, retention interval, and recall variables are discussed, providing a background against which more recent literature dealing with operational spaceflights tasks is compared and assessed. Detailed and summary abstracts of research reports having particular relevance to the problem of spaceflight skill retention are provided.
Author

N73-10153*# Boeing Co., Seattle, Wash.
DEGRADATION OF LEARNED SKILLS. EFFECTIVENESS OF PRACTICE METHODS ON SIMULATED SPACE FLIGHT SKILL RETENTION Technical Report, Jul. 1970 - May 1971
Thomas E. Sitterley and Wayne A. Berge Jul. 1972 96 p refs
(Contract NAS9-10962)
(NASA-CR-128612; D180-15081-1) Avail: NTIS HC $7.00 CSCL 05I

Manual flight control and emergency procedure task skill degradation was evaluated after time intervals of from 1 to 6 months. The tasks were associated with a simulated launch through the orbit insertion flight phase of a space vehicle. The results showed that acceptable flight control performance was retained for 2 months, rapidly deteriorating thereafter by a factor of 1.7 to 3.1 depending on the performance measure used. Procedural task performance showed unacceptable degradation after only 1 month, and exceeded an order of magnitude after 4 months. The effectiveness of static rehearsal (checklists and briefings) and dynamic warmup (simulator practice) retraining methods were compared for the two tasks. Static rehearsal effectively countered procedural skill degradation, while some combination of dynamic warmup appeared necessary for flight control skill retention. It was apparent that these differences between methods were not solely a function of task type or retraining method, but were a function of the performance measures used for each task.
Author

N73-10154*# National Aeronautics and Space Administration, Washington, D.C.
SOME RESULTS OF THE DEVELOPMENT AND INVESTIGATION OF INSTRUMENTS FOR MONITORING THE CARDIOVASCULAR SYSTEM
I. N. Krayev Jul. 1972 13 p refs Transl. into ENGLISH from the publ. "Avtomaticheskii kontrol i metody elektricheskikh izmerenii, Vol. 2" Novosibirsk, Nauka, 1971 p 190-197
(NASA-TT-F-14492) Avail: NTIS HC $3.00 CSCL 06B

A set of electronic instruments developed to study the heart, and to obtain more correct information on the functioning of the heart, is discussed. Included are a blood analyzer, an instrument for studying the blood coagulation process, an automatic sphygmomanometer, and an electromagnetic blood flow meter.
Author

N73-10155*# National Aeronautics and Space Administration, Washington, D.C.
LIFE SUPPORT SYSTEMS OF SPACECRAFT
G. Voronin, A. Polivoda, and Ye. Vinogradov Jun. 1972 15 p Transl. into ENGLISH from Aviat. Kosmonavt. (Moscow), v. 9, 1966 p 44-47
(NASA-TT-F-14436) Avail: NTIS HC $3.00 CSCL 06K

The supply and biosynthetic systems for the life support of a spacecraft are discussed, along with the regenerated physico-chemical systems.
J.A.M.

N73-10156*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MEDICAL INFORMATION MANAGEMENT SYSTEM (MIMS): A GENERALIZED INTERACTIVE INFORMATION SYSTEM
Sidney Alterescu, Ronald A. Schwarz (Federal City Coll.), and Louis S. Collins (Federal City Coll.) Sep. 1972 113 p
(NASA-TM-X-66076; X-207-72-374) Avail: NTIS HC $7.75 CSCL 05B

An interactive information system is described. It is a general purpose, free format system which can offer immediate assistance where manipulation of large data bases is required. The medical area is a prime area of application. The report is designed to serve as a manual for potential users- nontechnical personnel who will use the system. Examples of the system's operation, commentary on the examples, and a complete listing of the system program are included.
Author

N73-10157# Royal Aircraft Establishment, Farnborough (England).
SOME EXPERIMENTS ON THE FRICTION OF FABRICS ON HUMAN SKIN
J. E. Swallow and M. Webb Mar. 1972 20 p refs
(RAE-TR-72037; BR-28659) Avail: NTIS HC $3.00

A method is described for measuring the friction of fabrics on human skin with particular relevance to the comfort of aircrew tropical clothing. The effects of fabric wetness, skin hairiness, operator difference, normal load and direction of fabric threads relative to the direction of pull have been investigated for six tropical overall fabrics.
Author (ESRO)

N73-10158# Human Resources Research Organization, Alexandria, Va.
DETERMINING TRAINING DEVICE REQUIREMENTS IN FIXED WING AVIATOR TRAINING Final Report
Paul W. Caro, Oran B. Jolley, Robert N. Isley, and Robert H. Wright Apr. 1972 61 p refs
(Contract DAHC19-70-C-0012)
(AD-744447; HumRRO-TR-72-11) Avail: NTIS CSCL 05/9

A systematic study of all fixed wing pilot training programs at the U.S. Army Aviation School was conducted in Fy 1968. The objective was to determine whether training might be made more effective through greater use of synthetic flight training equipment and, if so, to specify the main characteristics of appropriate equipment. Secondary objectives were to assist in developing low cost devices for one course and to determine the probable cost-effectiveness of a commercially available device in another. A method was developed which identified specific and differential needs for synthetic equipment in each course and determined suitability of existing equipment to meet those needs. A generalizable, systematic method for determining requirements for synthetic training equipment in existing training programs resulted.
Author (GRA)

N73-10159# American Inst. of Aeronautics and Astronautics, New York.
AIAA EMPLOYMENT WORKSHOPS. VOLUME 2: AN ANALYTIC REPORT ON SOME EFFECTS OF TWENTY-TWO WORKSHOPS Final Report, 1 Sep. 1970 - 31 Dec. 1971
Leonard Smith Jan. 1972 72 p
(Contract DL-82-36-71-01)
(PB-209367; DLMA-82-36-71-01-2-Vol-2) Avail: NTIS HC $3.00 CSCL 05I

Volume 2 of a two volume report is a detailed analysis made of attendees of 22 selected employment workshops put on by the American Institute of Aeronautics and Astronautics, the purpose of which was to teach unemployed aerospace and defense engineers and scientists how to look for work competitively. The attendees were surveyed during and at the conclusion of the three session workshops, two months after the conclusion of the workshop and six months after the conclusion of the workshop. The volume reports in detail on the profile of

the attendees, their attitudes and their successes and failures in job hunting, what kinds of jobs they sought and found, and to what those who were successful attributed that success. GRA

N73-10160# Army Natick Labs., Mass. Clothing and Personal Life Support Equipment Lab.
THE BODY SIZE OF SOLDIERS: US ARMY ANTHROPOMETRY, 1966 Final Report, 1966 - 1971
Robert M. White Dec. 1971 342 p refs
(DA Proj. 1K0-24701-A-122)
(AD-743465; C/PLSEL-94; USA-NLABS-TR-72-51-CE) Avail: NTIS CSCL 06/1

As a part of the U.S. Armed Forces anthropometric surveys of 1966, a sample of 6682 Army men was measured, including basic trainees, infantrymen, armored crewmen, and aviation personnel. Seventy body measurements were taken on each man. The anthropometric data from this survey are presented and discussed. These new data represent the first major updating of body size information on U.S. Army personnel since the Army anthropometric survey of 1946. Changes in the body size of Army men between 1946 and 1966 are discussed and the Army data are compared with anthropometric data from other services. Author (GRA)

N73-10161# Air Force Human Resources Lab., Williams AFB, Ariz. Flying Training Div.
EVALUATION OF AIRBORNE AUDIO-VIDEO RECORDINGS AS A TOOL FOR TRAINING IN THE A-7D TACTICAL FIGHTER
Joe A. Fitzgerald and David L. Moulton Oct. 1971 9 p
(AF Proj. 1123)
(AD-744041; AFHRL/FT-TR-72-55) Avail: NTIS CSCL 05/9

The report documents the results of a study to evaluate an airborne audio video recording system in a Head-Up Display (HUD) equipped fighter aircraft, the A-7D, as a method of improving the quality of training. The results, although lacking quantitative rigor, indicate that the use of audio video recording equipment can be of real value in the training of fighter pilots. It is recommended that such capability be a basic design consideration in all new fighter aircraft. Author (GRA)

N73-10162# Anthropology Research Project, Yellow Springs, Ohio.
ANTHROPOMETRY OF US ARMY AVIATORS, 1970 Final Report, Nov. 1969 - Dec. 1971
Edmund Churchill, John T. McConville, Lloyd L. Laubach, and Robert M. White Dec. 1971 342 p refs
(Contract DAAG17-70-C-0055)
(AD-743528; USA-NLABS-TR-72-52-CE) Avail: NTIS CSCL 06/14

The report describes an anthropometric survey of U.S. Army aviators conducted at Fort Rucker, Alabama in 1970. Data for 85 body size measurements and for several variables describing the socio-military background of the survey subjects were gathered on a sample of 1482 flying personnel. Statistical summaries are presented for each measurement for the entire sample and for five subseries: enlisted men (crew chiefs, mechanics, door gunners), warrant officer and warrant officer candidate trainees, warrant officer rated pilots, commissioned trainees, and commissioned pilots. Summary statistics and percentiles for 80 anthropometric indices and for some 73 anthropometric variables computed from the measured dimensions are given, as is the correlation matrix for the measured variables and age.
Author (GRA)

N73-10163# Naval Submarine Medical Center, Groton, Conn.
FURTHER TESTS OF TRAINING TECHNIQUES TO IMPROVE VISUAL-MOTOR COORDINATION OF NAVY DIVERS UNDERWATER Interim Report
Christine L. McKay, Jo Ann S. Kinney, and S. M. Luria 26 Oct. 1971 15 p refs
(M430603)
(AD-744936; NSMRL-684) Avail: NTIS CSCL 05/9

Two underwater experiments were undertaken to facilitate a diver's adjustment to the underwater distortion. One group of divers was given previous exposure to magnifying lenses before entering the water while a second group received one training session a week for ten weeks. Neither technique significantly improved the amount of adaptation found in previous studies. Inter-subject variability was high, however, with one subject showing practically complete adjustment for the distortion. Some preliminary screening tests might be devised to select future divers on the basis of relevant variables, including relative adaptability. Author (GRA)

N73-10164# Naval Postgraduate School, Monterey, Calif.
VIBRATION EFFECTS ON PILOT TRACKING PERFORMANCE USING A RIGID CONTROL STICK M.S. Thesis
Peter Thomas Rodrick Mar. 1972 64 p refs
(AD-745193) Avail: NTIS CSCL 05/10

A simulator facility was built to study the effects of vibration on pilot tracking performance using a rigid control stick. Tests were conducted at frequencies from 5 to 50 hertz and accelerations up to 1.5 g's. Two vibration environments were studied: control stick vibration and whole body vibration. Twenty-two different frequency/g-level combinations were tested. The order of the runs was varied for each subject in an attempt to cancel out consistent learning effects. In general, performance scores for whole body vibration were lower than those for control stick only vibration although g-levels were less. All subjects experienced greater discomfort on the whole body vibration tests. All subjects showed a noticeable drop in performance on some runs in the 20-25 Hz frequency range. Author (GRA)

N73-10165# Army Medical Research Lab., Fort Knox, Ky.
AUDITORY FEEDBACK AND CONDITIONING OF THE SINGLE MOTOR UNIT Interm Report
Bruce C. Leibrecht, Andree J. LLoyd, and Sadie C. Pounder 15 Mar. 1972 13 p refs
(DA Proj. 3A0-61102-B-71-P)
(AD-745107; USAMRL-971) Avail: NTIS CSCL 05/10

The effects of direct auditory feedback of the electromyogram (EMG) on learning to control a single motor unit (SMU) were investigated. Seventeen human subjects were injected with bipolar fine-wire electrodes into the tibialis anterior muscle. A trial light indicated the onset of a trial. If the subject activated an SMU, a correct light appeared. A non-SMU response was followed by an incorrect light. All subjects received an initial training series with auditory EMG feedback followed by a retest at 2 weeks without EMG feedback. Speed of initial learning was substantially improved by direct EMG feedback. The nature and amount of learning, including the ability to use proprioceptive cues in controlling an SMU, were not affected, nor was retention of learning. Author (GRA)

N73-10166# Matrix Research Co., San Mateo, Calif.
UH-1H JOB PERFORMANCE TESTS (VNAF) SERIES TS-1
1 Sep. 1971 24 p
(Contract F33615-70-C-1550)
(AD-745163) Avail: NTIS CSCL 05/9

The TS-1 test is one of a series of 10 advanced type job performance tests which were developed for an assessment of the effectiveness of the UH-1H (helicopter) job performance aids (JPA) in use by the Vietnamese Air Force (VNAF). It includes a test on troubleshooting and repairing a helicopter with a bad fuel start solenoid, procedures for inserting faults for correction, maintenance tasks, an information questionnaire on the technician's experience and training, a test of malfunction in helicopter starting, an instruction manual and guide, a performance evaluation sheet, and a form for recording the test conditions. GRA

N73-10167# Texas Univ., Austin.
BANDWIDTH REDUCTION OF SLEEP INFORMATION, VOLUME 2 Final Report, Sep. 1970 - Nov. 1971
A. J. Welch, Philip C. Richardson, Jane Mockford, and Joanne M. Aldredge 1 Nov. 1971 100 p refs
(Contract F41609-71-C-0002; AF Proj. 6319)
(AD-740946; TR-115-Vol-2) Avail: NTIS CSCL 06/2

The report discusses the possibility of extracting sleep information from heart rate data. Eight hours of sleep EEG, EOG and electrocardiograms were recorded on FM magnetic tape for two nights for each of eight subjects. The time in milliseconds between heart beats was written on digital magnetic tape. The data were grouped into records containing 128 consecutive beat-to-beat intervals and a large number of descriptors was computed for each record. These descriptors for each record

were the mean value, the sample variance, the nine-interval histogram of Z scores, and a set of Fourier transforms. Analysis of variance was used as a general guide to descriptor significance for each subject. The discriminant analysis procedure described by Rao and popularized by Cooley and Lohnes was used to sleep stage classify heart rate data. Accuracy of the procedure was determined in terms of percent correct classifications, correlation coefficient of the computerized sleep pattern with respect to the EEG hand scored pattern, and an empirically derived cost function. Author (GRA)

N73-10168# American Inst. of Aeronautics and Astronautics, New York.
AIAA EMPLOYMENT WORKSHOPS, VOLUME 1 Final Report, 1 Sep. 1970 - 31 Dec. 1971
Geoffrey A. Potter Jan. 1972 50 p
(Contract DL-82-36-71-01)
(PB-209366; DLMA-82-36-71-01-1-Vol-1) Avail: NTIS $3.00 CSCL 05I

The report shows how and why AIAA devised and then operated 175 employment workshops for 14,600 unemployed engineers and scientists from the defense and aerospace industry in 43 cities across the country. Discussed are the successes and failures of the program and why AIAA thinks they happened. The workshops were designed to help unemployed professionals unaccustomed to having to look for work competitively to do so by teaching them through a peer group discussion technique how to understand the market situation. GRA

N73-10169# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN INVESTIGATION OF THE SYNCODER AS A PULSE INTERVAL PROCESSING DEVICE M.S. Thesis
Richard B. Zellmer Jun. 1972 105 p refs
(AD-746007; GGC/EE/72-19) Avail: NTIS CSCL 06/4

An investigation of a neural model called the syncoder is performed in which syncoder design, operation, and interconnected networks are reviewed. A regular rectangular-wave pulse train is used as a simulated neural pulse train, and a syncoder network capable of discriminating between temporally adjacent pulses is presented. This temporal discrimination device is then modified to create an interpulse interval recognition network capable of identifying rectangular wave interpulse intervals in the range 0.002 to 0.040 seconds. A syncoder network capable of detecting a simple pulse sequence defined by both spatial and temporal aspects of pulse occurrence is also developed. Finally, a conjectural scheme is suggested by which such interpulse interval and sequence detection devices might be combined to perform elementary neural information processing.
Author (GRA)

N73-10170# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
LASER SAFETY GOGGLES Final Report
19 Jun. 1972 17 p refs
(AD-746208; TOP-10-3-198) Avail: NTIS CSCL 06Q

The report describes a method for the evaluation of laser safety goggles physical and functional performance characteristics. It identifies supporting test, facilities, and equipment required and provides procedures for preoperational inspection, physical characteristics, safety, personnel training, compatibility with combat tasks, durability, maintainability, human factors, and value analysis. The method is applicable to test without laser beam use. Tests for laser radiation screening out capability are excluded. Author (GRA)

N73-10023* Virginia Univ., Charlottesville. Center for Application of Science and Engineering to Public Affairs.
INVESTIGATION OF TRAVELER ACCEPTANCE FACTORS IN SHORT HAUL AIR CARRIER OPERATIONS
A. R. Kuhlthau and Ira D. Jacobson *In* NASA. Langley Res. Center Symp. on Vehicle Ride Quality Oct. 1972 p 211-228 refs (For availability see N73-10012 01-02)
CSCL 05E

N73-10024* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RIDE QUALITY RESEARCH ACTIVITIES AT NASA LANGLEY RESEARCH CENTER
Andrew B. Connor, Hugh P. Bergeron, and W. Elliott Schoonover, Jr. *In its* Symp. on Vehicle Ride Quality Oct. 1972 p 229-248 refs (For availability see N73-10012 01-02)
CSCL 05E

06 CHEMISTRY

Includes chemical analysis and identification (e.g. spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N73-10171 National Lending Library for Science and Technology, Boston Spa (England).
REACTION BETWEEN REFRACTORY COMPOUNDS AND CARBON
Yu. V. Levinskii, K. I. Portnoi, and S. E. Salibekov Aug. 1972 14 p refs Transl. into ENGLISH from the publ. "Vzaimodeleistvie Materialov Vysokotemperaturnogo Naznacheniya so Sredoi" Kiev, 1968 p 175-185
(NLL-RTS-7425) Avail: Natl. Lending Library, Boston Spa, Engl.: £1.40; 5 NLL photocopy coupons

A study of the high temperature reaction of carbon with refractory borides, carbides, and nitrides of metals in groups 4, 5, and 6 is presented. A determination was also made of high temperature solubility of carbon and its fusion temperature.
Author

N73-10172*# Beckman Instruments, Inc., Fullerton, Calif. Advanced Technology Operations.
ADDITIONAL STUDIES FOR THE SPECTROPHOTOMETRIC MEASUREMENT OF IODINE IN WATER Final Report
31 Aug. 1972 40 p
(Contract NAS9-12769)
(NASA-CR-128585; FR-1116-101) Avail: NTIS HC $4.00 CSCL 07D

Previous work in iodine spectroscopy is briefly reviewed. Continued studies of the direct spectrophotometric determination of aqueous iodine complexed with potassium iodide show that free iodine is optimally determined at the isosbestic point for these solutions. The effects on iodine determinations of turbidity and chemical substances (in trace amounts) is discussed and illustrated. At the levels tested, iodine measurements are not significantly altered by such substances. A preliminary design for an on-line, automated iodine monitor with eventual capability of operating also as a controller was analyzed and developed in detail with respect single beam colorimeter operating at two wavelengths (using a rotating filter wheel). A flow-through sample cell allows the instrument to operate continuously, except for momentary stop flow when measurements are made. The timed automatic cycling of the system may be interrupted whenever desired, for manual operation. An analog output signal permits controlling an iodine generator. Author

N73-10173*# AiResearch Mfg. Co., Los Angeles, Calif.
A TRANSIENT PERFORMANCE METHOD FOR CO2 REMOVAL WITH REGENERABLE ADSORBENTS
K. C. Hwang Oct. 1972 241 p refs
(Contract NAS1-8559)
(NASA-CR-112098; Rept-72-8786) Avail: NTIS HC $14.25 CSCL 02D

A computer program is described which can be used to predict the transient performance of vacuum-desorbed sorbent beds for CO2 or water removal, and composite beds of two sorbents for simultaneous humidity control and CO2 removal. The program was written primarily for silica gel and molecular sieve inorganic sorbents, but can be used for a variety of adsorbent materials. Part 2 of this report describes a computer program which can be used to predict performance for multiple-bed CO2-removal sorbent systems. This program is an expanded version of the composite sorbent bed program described in Part 1. Author

N73-10174*# Scientific Translation Service, Santa Barbara, Calif.
ELECTRIC CONDUCTIVITY OF IODINE SOLUTIONS. 3: ELECTRIC CONDUCTIVITY OF THE SYSTEM: I-Me4NI

Ya. A. Fialkov and N. V. Akselgrud Washington NASA Oct. 1972 13 p refs Transl. into ENGLISH from Zh. Obshch. Khim. (Moscow), v. 13, 1943 p 753-761
(Contract NASw-2035)
(NASA-TT-F-13911) Avail: NTIS HC $3.00 CSCL 07D

Electric conductivity of the system I-Me4NI was determined up to 9.2 mol.% of the latter at 130, 140 and 150 deg. It rapidly increases with concentration and reaches the magnitude of 0.1 mho at 5 mol.%; beyond this concentration the rate of increase of specific electroconductivity is less, and at the highest concentration used it is 0.171 mho at 130 deg. and 0.189 mho at 150 deg. Comparison of specific and mol. conductivities of this system and those of I solutions of KI and RbI shows considerable similarity of isotherms of conductivity and in respect to variations with concentration and temperature. The electrolyte in the system studied is considered to consist of associated molecules of probable formula (Me4NI9)2. Author

N73-10175*# National Aeronautics and Space Administration, Washington, D.C.
CONCERNING CHEMILUMINESCENCE OF RHODAMINE C
L. G. Bolshakova and V. A. Vasiliyeva Jun. 1972 16 p refs Transl. into ENGLISH from Probl. Fiz. Atmosfery (Leningrad), collection no. 6, 1968 p 78-86
(NASA-TT-F-14423) Avail: NTIS HC $3.00 CSCL 07D

A chemiluminescence method of measuring ozone in the atmosphere is described. Methods of preparing chemiluminescent materials using Reginer's technique involving Rhodamine C are discussed, as well as the luminescence spectrum of this material and results of preliminary photoelectric measurements. Author

N73-10176# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
SHOCK-TUBE MEASUREMENTS OF SOOT OXIDATION RATES
Chul Park and John P. Appleton Jul. 1972 32 p refs
(Grant NSF GK-33933)
(FML-Publ-72-8) Avail: NTIS HC $3.75

Surface oxidation rates of two types of carbon black, which are representative of soot formed during the combustion of hydrocarbon fuels, have been measured in a shock tube over the ranges of temperature between 1700 and 4000 deg. K and pressure between 0.05 and 13 atm of oxygen. The results illustrate that the specific surface reaction rate is nearly the same as that which has previously been measured for the oxidation of polycrystalline pyrographite, and that the results can be approximately correlated by a semi-empirical formula for pyrographite oxidation. Author

N73-10177*# Agnew Tech-Tran, Woodland Hills, Calif.
METHODS FOR THE STUDY OF ABSORPTION SPECTRA OF COLLOIDAL SOLUTIONS OF CONSIDERABLE THICKNESS
E. S. Smokinskiy, V. E. Palamaryuk, A. T. Dimitrashchuk, and S. G. Guminetskiy Washington NASA Sep. 1972 9 p refs Transl. into ENGLISH from Zh. Prikl. Spektroskopii (USSR), v. 14, no. 3, Mar. 1971 Prepared for JPL
(Contract NAS7-100)
(NASA-TT-F-14497) Avail: NTIS HC $3.00 CSCL 07D

A method is presented for determining the absorption coefficient and dispersion factor for a light-diffusing colloidal solution. The equipment and procedures are described, and it is concluded that this method can be used for investigating the absorption spectra of light dispersing media. F.O.S.

N73-10178# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL RESEARCH ON THE VISCOSITY OF META-XYLENE AT HIGH PRESSURES AND TEMPERATURES
A. M. Mamedov, T. S. Akhundov, and A. D. Tairov 25 Apr. 1972 11 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Neft i Gaz (Baku), v. 9, no. 11, 1966 p 71-74
(AD-745851; FTD-HT-23-1274-71) Avail: NTIS CSCL 07/4

The viscosity of m-xylene was determined at given intervals by the capillary method. The experimental unit consisted of a capillary viscometer made of refractory glass and housed in a high-pressure chamber. The given values are graphically depicted. GRA

N73-10179# Space Sciences, Inc., Monrovia, Calif.
A MASS SPECTROMETRIC INVESTIGATION OF ADDITIONS IN ALKALI SEEDED H2/O2 FLAMES. PART 1: REACTIONS INVOLVING TUNGSTEN AND MOLYBDENUM WITH POTASSIM SEEDED H2/O2 FLAMES. PART 3: REACTIONS INVOLVING VANADIUM AND CHROMIUM WITH POTASSIUM-SEEDED H2/O2 FLAMES
Milton Farber and R. D. Strivastava Jun. 1972 30 p refs
(Contract N00014-69-C-0014)
(AD-743514; SSI-TR-3-Pt-1) Avail: NTIS CSCL 07/4

Studies have been made for the reactions involved with molybdenum, tungsten, vanadium and chromium additives in hydrogen-oxygen flames seeded with potassium. The flame was atmospheric and a molecular beam of the frozen species was introduced into the mass spectrometer through a four-stage differential pumping system operating from 1 to 10 to the -11th power atm. Author (GRA)

N73-10985* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Propulsion Div.
LONG TERM AGING OF ELASTOMERS: CHEMORHEOLOGY OF VITON B FLUOROCARBON ELASTOMER
S. H. Kalfayan, R. H. Silver, A. A. Mazzeo, and S. T. Lui *In its* JPL Quart. Tech. Rev., Vol. 2, No. 3 Oct. 1972 p 32-39 refs (For availability see N73-10981 01-34)
CSCL 07D

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N73-10180 British Broadcasting Corp., Kingswood (England). Engineering Div.
THE FEASIBILITY OF CORRECTING FOR FAILURE OF CONSTANT LUMINANCE IN A COLOUR TELEVISION SYSTEM
D. T. Wright Aug. 1972 9 p
(BBC-1972/29) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

In a colour television transmission system such as the PAL system a constant-luminance failure is caused because the red, green and blue separation signals used to form the chrominance and luminance signals are not linearly related to the light outputs required from the red, green and blue display picture-tube phosphors. As a result, not all of the displayed luminance information travels via the luminance channel and the remainder, which travels via the chrominance channel, suffers a severe bandwidth restriction. It is possible, by modifying the coding process, to retain the otherwise lost information concerning fine detail associated with saturated colours by redirecting it to the luminance channel. This results in a high-frequency boost of the luminance signal where there is fine detail associated with highly saturated colours in the picture. The resulting possibility of increased cross-colour, and the effect of the high-frequency boost on the monochrome picture are briefly discussed. Author

N73-10181 Royal Radar Establishment, Malvern (England).
RRE NEWSLETTER AND RESEARCH REVIEW
1972 133 p refs
(RRE-11) Copyright. Avail: Issuing Activity

Research on radar and microwave equipment, subsystems, and materials is summarized. The theoretical physics underlying the processes is emphasized. The areas of study include solid state devices, semiconductor materials and devices, liquid crystals, display devices, infrared devices, lasers, acoustic surface wave devices, integrated circuit fabrication, radar measurements of the atmosphere, and supporting computer techniques. N.E.N.

N73-10182 British Broadcasting Corp., Kingswood (England). Research Dept.
A RAPID GRAPHICAL METHOD OF EVALUATING THE CHROMATIC PROPERTIES OF A TELEVISION DISPLAY
1972 16 p refs
(BBC-1972/30) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The use of a set of six charts or error diagrams is described in which the chromaticity and relative luminance of a particular test color, when reproduced by a color television display, may be immediately obtained knowing the effective chromaticities of the three display primaries. An assessment of the accuracy of the method is also given. Author

N73-10183 British Broadcasting Corp., Kingswood (England). Research Dept.
DIGITAL SOUND SIGNALS: FURTHER INVESTIGATION OF INSTANTANEOUS AND OTHER RAPID COMPANDING SYSTEMS
1972 12 p refs
(BBC-1972/31) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The limitations of simulation techniques to evaluate the use of instantaneous companding for broadcast quality, sound pulse code modulation systems are described. The development of a more flexible method for simulating both instantaneous and near-instantaneous companding is discussed. It is concluded that considerable benefits are derived from the near-instantaneous form of companding. Author

N73-10184*# Harvard Univ., Cambridge, Mass. Gordon McKay Lab.
THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF ANTENNAS AND WAVES IN PLASMA Final Report, 1 Sep. 1965 - 31 Dec. 1970
12 Jun. 1972 21 p
(Grant NGR-22-007-056)
(NASA-CR-130076) Avail: NTIS HC $3.25 CSCL 17B

The near field characteristics of an antenna when it is covered by a plasma sheath were investigated. The areas of investigation were: (1) current distribution, (2) input admittance, and (3) radiation pattern as functions of the electrical length of the antenna. Diagnostic measurements were also made to determine the properties of the plasma. A numerical method was evolved to solve the problem of a finite cylindrical antenna in an infinite plasma column. Author

N73-10185# Nagoya Univ. (Japan). Inst. of Plasma Physics.
PHYSICAL PICTURE FOR THE ANOMALOUS PROPAGATION OF ORDINARY ELECTROMAGNETIC WAVES IN A PLASMA
Burton D. Fried Jun. 1972 11 p refs
(IPPJ-130) Avail: NTIS HC $3.00

It is shown that the physical mechanism for the anomalous propagation of electromagnetic waves at frequencies below the plasma frequency is due to the deflection of particles thermal motion by the wave magnetic field, leading to a density perturbation which can be large when enhanced by some resonance. In presence of an external magnetic field, cyclotron resonance provides the enhancement for ordinary waves and wave-particle resonance giving rise to anomalous propagation, if the velocity distribution is anisotropic with respect to the wave vector, with phase velocity less than the velocity of light. The Weibel instability, which also occurs with such a distribution function, relies upon the same physical mechanism. Author

N73-10186# Physics Lab. RVO-TNO, The Hague (Netherlands).
SMOOTHING AND DIFFERENTIATION OF THE OUTPUT OF A DOPPLER RADAR BY A DIGITAL SPECTRAL-ANALYTIC METHOD
F. P. Ph. DeVries Jan. 1972 108 p refs In DUTCH; ENGLISH summary
Avail: NTIS HC $7.50

A digital method for smoothing and differentiating the output of a Doppler radar is presented. The raw output of the radar is transformed into the frequency domain. Then the appropriate filtering and differentiation operations are performed followed by an inverse transformation. In particular attention has been focused on two problems: (1) signal modification in order to avoid transient effects, and (2) the determination of the filter's transfer function given the signal and noise model and the transformed raw radar output. Author

N73-10187# Advisory Group for Aerospace Research and Development, Paris (France).
AEROSPACE TELECOMMUNICATIONS SYSTEMS
Aug. 1972 355 p refs Partly in ENGLISH and partly in FRENCH Proc. of the 23d Tech. Meeting of the Avionics Panel of AGARD, London, 15-18 May 1972
(AGARD-CP-103) Avail: NTIS HC $19.75

Expanded telecommunication system requirements can be met by data compression methods and digital imaging schemes, efficient bandwidth utilization and adaptation techniques, tactical environment ground terminal measurements for satellite communications, and digital/analog communications for automatic message systems and interference suppression. For individual titles, see N73-10188 through N73-10213.

N73-10188 Royal Aircraft Establishment, Farnborough (England). Radio Dept.
TECHNICAL EVALUATION REPORT ON 23D AVIONICS PANEL TECHNICAL MEETING ON AEROSPACE TELECOMMUNICATIONS SYSTEMS, 15-18 MAY 1972
P. G. Whicher *In* AGARD Aerospace Telecommun. Systems Aug. 1972 9 p (For availability see N73-10187 01-07)

Activities in telecommunications research and development, and in network planning monitoring, and utilization are reported. An important conclusion formed states that digital techniques offer real prospects of supplanting traditional analog methods in a wide range of future applications in aerospace systems. Emphasis is placed on growing problems of electromagnetic compatibility, interference, and jamming and the difficulties of accomodating multiple satellite systems in synchronous orbit. G.G.

N73-10189 Laboratoire Central de Recherches Thomson-CSF, Orsay (France). Div. Materiels Avioniques et Spatiaux.
REDUCTION OF APPLIED REDUNDANCY IN THE TRANSMISSION OF IMAGES [REDUCTION DE LA REDONDANCE APPLIQUEE A LA TRANSMISSION DES IMAGES]
T. A. Hawkes and P. A. Simonpieri *In* AGARD Aerospace Telecommun. Systems Aug. 1972 14 p refs In FRENCH (For availability see N73-10187 01-07)

A procedure relevant to the simple reduction of applied redundancy in image transmission is presented. The algorithm treatment and known reception permits the reconstruction of signals without transmitting the information over the length of the pattern interval. After an evaluation of all possible procedures, the effect of first simulation elements on the ordinates of the proposed algorithm with image restoration imprints is examined. Essential parameters, functions of the system, and the results obtained are given. Transl. by E.H.W.

N73-10190 Perkin-Elmer Corp., Norwalk, Conn.
DIFFERENTIAL PULSE CODE MODULATION TRANSMISSION OF SAMPLED AERIAL IMAGERY
R. J. Arguello, H. R. Sellner, and J. A. Stuller *In* AGARD Aerospace Telecommun. Systems Aug. 1972 20 p refs (For availability see N73-10187 01-07)

An analysis, simulation and discussion of the effects of quantizer noise and communication errors on differential pulse code modulation (DPCM) transmission of sampled aerial imagery are reported. Simulations are presented that describe: (1) DPCM transmission of photographic scenes which have been scanned and sampled at the Nyquist rate, and (2) the effects of inserting periodic PCM updates in order to correct DPCM communication errors. Two, three and four bit DPCM transmission systems are discussed. Author

N73-10191 Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
COMPUTER AIDED EVALUATION OF RECONNAISSANCE IMAGE COMPRESSION SCHEMES USING AN ON-LINE INTERACTIVE FACILITY c08
J. C. Mott-Smith, F. H. Cook, and J. M. Knight (Mitre Corp., Bedford, Mass.) *In* AGARD Aerospace Telecommun. Systems Aug. 1972 20 p refs (For availability see N73-10187 01-07)

(Contract F19628-71-C-0002)
A method is proposed of evaluating compression algorithms applied to pictures and applied to several well-known techniques, most of which already have one or more hardware implementations. General conclusions are that delta modulation and differential pulse code modulation which use three or fewer bits per picture element are detrimental, and that the zero- and first-order predictors may give some compression but certainly less than a factor of two on the average. The defects in the algorithms which limit their usefulness on pictorial data is identified with their poor correlation from one line of the picture to the next. The importance of proper data management for pictorial communication is illustrated, and by implication, shown to be much more important than the data compression algorithms. Relevant to the data management proposals, some methods of improving the cosmetic quality of sparsely sampled images are shown. Author

N73-10192 Rensselaer Polytechnic Inst., Troy, N.Y. Systems Engineering Div.
A TUTORIAL ON DIGITAL TECHNOLOGY WITH EMPHASIS ON DIGITAL COMMUNICATIONS AND FILTERING
Lester A. Gerhardt *In* AGARD Aerospace Telecommun. Systems Aug. 1972 7 p refs (For availability see N73-10187 01-07)
(Contracts AF 49(638)-1627; DAAB07-69-C-0365)
The major advantages of a digital approach to communications are considered and digital technology and its effect on communications are outlined. Under the umbrella of a generalized model of a digital communications system, the status of the theory is reviewed and practical implementations are given. The relationship between theory and practice is emphasized using digital filtering as typical of the achievements in this area. Author

N73-10193 Politecnico di Torino (Italy). Ist. di Elettronica e Telecomunicazioni.
ON THE EFFICIENT BANDWIDTH UTILIZATION IN DIGITAL TRANSMISSION
S. Benedetto, V. Castellani, C. Cianci (Centro Studi e Laboratori Telecomunicazioni), and U. Mazzei (Studi e Laboratori Telecomunicazioni) *In* AGARD Aerospace Telecommun. Systems Aug. 1972 13 p refs (For availability see N73-10187 01-07)
The problem of the efficient bandwidth utilization of a digital transmission channel is investigated by working out a complete example with a rather realistic channel model. The bandwidth efficiency in digital transmission is contrasted by the channel distortion impairments. A useful shaping of the signal spectrum and the use of a transversal equalizer are analyzed. Multilevel SSB amplitude modulated signals are assumed. System performances are discussed and evaluated using two different criteria: the peak distortion of the received signal and the average error probability of the received sequence. A general description of the different parts of the system is first given and a detailed discussion of the evaluation procedures is presented. Results are given for PAM and partial response coded (PRC) signalling schemes. System evaluation is finally discussed in terms of bandwidth efficiency. Author

N73-10194 Service Technique des Telecommunications de l'Air, Paris (France).
UTILIZATION AND SUPPLENESS OF HIGH NUMERICAL DISCHARGE SUPPORT IN TELECOMMUNICATIONS [UTILISATION ET SOUPLESSE D'UN SUPPORT NUMERIQUE A DEBIT ELEVE DANS UN SYSTEME DE TELECOMMUNICATIONS]
G. Bomont (Service Tech. de la Navigation Aerienne), P. Breant, and G. David *In* AGARD Aerospace Telecommun. Systems Aug. 1972 12 p refs In FRENCH (For availability see N73-10187 01-07)
The use of numerical control to compress syllabic delta modulated voice signals in air navigation telecommunication systems is discussed. The principles of the multiplexing numerical system and the transmission methods utilized are given. An organizational air navigation control system is illustrated.
Transl. by E.H.W.

N73-10195 Texas Instruments, Inc., Dallas.
SYNTHESIS AND EVALUATION OF AN OPTIMUM SAMPLED DATA FM DEMODULATOR
Alan L. McBride *In* AGARD Aerospace Telecommun. Systems Aug. 1972 11 p refs (For availability see N73-10187 01-07)
(Contract F30602-70-C-0180)
A digitalized or sampled-data FM demodulator recursive algorithm is synthesized and its signal-to-noise ratio performance evaluated. A recursive estimator is derived that optimally estimates the message of a noisy sampled FM process. The incoming analog noisy FM process is in-phase and quadrature sampled to reduce the bandpass RF waveform to a sampled baseband process. The modulating process is modeled as a discrete linear filter by state variable techniques. The maximum a posteriori (MAP) criterion is used to develop a recursive cost function. Minimization techniques used in optimal control theory are employed to derive the two-point boundary-value (TPBV) problem from this cost-function. Discrete invariant imbedding is then used to solve the TPBV problem and obtain the recursive solution algorithm. A single-pole message filter example is reviewed. Discussed in this example are performance curves obtained by simulation of the inverse output mean-square error versus input carrier-to-noise ratio. The demodulator is shown to exhibit FM threshold extension capability. Author

N73-10196 Philco-Ford Corp., Palo Alto, Calif.
DIGITAL EQUIVALENT PSK RECEIVER TECHNIQUES
Francis D. Natali *In* AGARD Aerospace Telecommun. Systems Aug. 1972 13 p refs (For availability see N73-10187 01-07)
(Contract F30602-69-C-0099)
All-digital techniques for receiving and coherently detecting moderate data rate (less than 1 Mbps) PSK signals in real time are discussed. A receiver employing synchronous bandpass sampling and A/D conversion of the IF signal is described. Sampler synchronization, bit synchronization, and data detection are performed by a special-purpose digital processor. Analytical methods are developed for predicting receiver performance, and experimental data is presented to indicate the degree of agreement that one might expect. Author

N73-10197 Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
ADAPTIVE PRE-WHITENING FILTER
R. Klemm *In* AGARD Aerospace Telecommun. Systems Aug. 1972 7 p refs (For availability see N73-10187 01-07)
Some methods are shown for calculating the optimal linear pre-whitening filter function from real time computed correlation functions. The problem is due to the optimal detection of target signals in correlated noise in radar technique. In principle the received data are multiplied with the inverse of the correlation matrix of the noise; based on the Wiener theory, however, a linear function, that is, the first column of the inverse of the correlation matrix can also be given. Three methods are shown and discussed, by means of which it is possible to calculate the first column in real time without inverting the whole matrix.
Author

N73-10198 Mitre Corp., Bedford, Mass.
A FLEXIBLE HARDWIRED FAST FOURIER TRANSFORM DIGITAL PROCESSOR c08
E. A. Palo and G. C. O'Leary *In* AGARD Aerospace Telecommun. Systems Aug. 1972 15 p refs (For availability see N73-10187 01-07)
(Contract F19628-71-C-0002)
A hardwired digital processor based on the Cooley-Tukey algorithm is presented. A laboratory prototype has been built with two modes of operation. As a cascade fast Fourier transformer, it can simultaneously calculate transforms of two independent, continuous data streams at word rates in excess of 3 MHz. As a nonrecursive digital filter, it can produce filter impulse responses of up to 32 points. The digital filter also operates from data sources with word rates exceeding 3 MHz. The processor has been integrated into a system with other signal processing components including a small general purpose computer. Laboratory demonstration of the processing system as a spectrum analyzer and as an adaptive filter for distortion correction is discussed. Author

N73-10199 Siemens A.G., Munich (West Germany).
THE ADAPTIVE EQUALIZATION OF TRANSMISSION SYSTEMS

K. H. Moehrmann *In* AGARD Aerospace Telecommun. Systems Aug. 1972 16 p refs (For availability see N73-10187 01-07)

After a general introduction some of the principles of adaptive optimization are explained using as example the automatic identification of the transfer function of a linear system under operating conditions. Then several techniques for the automatic minimization of the linear distortions in communication channels are discussed with emphasis on telephone channels for fast transmission of digital data. Some filter structures suited for this purpose are described together with several possible strategies to implement the settings of the variable filter elements automatically during a training period before information transmission or in an adaptive manner during transmission. Finally, after discussing the partial-response technique and the equalization of digital data signals transmitted at high bit rates over long-haul coaxial carrier systems, some related applications of adaptive techniques are described concerning the equalization of long cable systems used for analog transmission of television signals, the equalization of FM/FDM radio relay systems due to elimination of intermodulation distortion and the adaptive cancellation of echoes in long distance telephone circuits.

Author

N73-10200 Rensselaer Polytechnic Inst., Troy, N.Y. Systems Engineering Div.

ADAPTIVE EQUALIZATION WITHOUT TEST TRANSMISSIONS

Chia-Chi Chen and Lester A. Gerhardt *In* AGARD Aerospace Telecommun. Systems Aug. 1972 14 p refs (For availability see N73-10187 01-07)

(Contracts DAAB07-69-C-0365; AF 49(638)-1627)

An extended gradient method for iteratively solving sets of linear equations has been developed and used here as the algorithm to perform adaptive equalization. Although stress has been placed on using this algorithm without test transmissions, for transversal equalizers, the algorithm may also be used with test transmissions as well as for recursive equalizers. Initially, stationary, binary, bipolar channels are equalized without test signals. For highly dispersive channels, the algorithm uses a variable history of past sequences to provide more effective equalization. The algorithm, if used when test signals are available, permits channels to be equalized with multilevel signals transmitted instead of confining transmission to the binary, bipolar case. The algorithm has also been proven useful for adapting as equalizer in conjunction with a time varying channel, because it can accomodate to rapidly varying characteristics. Author

N73-10201 North Atlantic Treaty Organization, Bruxelles (Belgium).

PROPAGATION CRITERIA WITH TACTICAL SATELLITE COMMUNICATIONS

H. J. Albrecht, M. Eggestad, and L. A. Maynard *In* AGARD Aerospace Telecommun. Systems Aug. 1972 13 p refs (For availability see N73-10187 01-07)

Tactical satellite communications may use a variety of frequency bands depending upon the application. Considering mobility and simplicity of equipment some of the more important aspects, the UHF range was found to be particularly suitable. In other words, operating frequencies are within the 200 to 400 MHz portion of the spectrum. Propagation criteria considered are: (1) scintillation effects due to ionospheric irregularities; (2) ray deviation caused by atmospheric layers; (3) multipath effects; and (4) transparency of surrounding materials. Scintillations are analyzed on the basis of experimental and theoretical results obtained. The subject of ray deviation is closely related to abnormal tropospheric conditions. With regard to multipath effects, the general aspects of ground reflections are analyzed for the purpose of evaluating their importance with mobile surface terminals. The problem of penetrating surrounding materials may be essential, whenever a porous obstacle, such as vegetation, is present in the path between surface terminal and satellite.

Author

N73-10202 North Atlantic Treaty Organization, Bruxelles (Belgium).

SYSTEM CONSIDERATIONS IN TACTICAL SATELLITE COMMUNICATIONS

H. J. Albrecht, R. Makaruschka, and R. Menzel *In* AGARD Aerospace Telecommun. Systems Aug. 1972 15 p refs (For availability see N73-10187 01-07)

The use of wide band satellites with frequency conversion and hard limiting displays certain disadvantages and limitations, particularly if the bandwidth is restricted to, e.g., 500 kHz in the UHF range. This causes the number of links to be limited if simultaneous operation is envisaged. Another possible system uses wide band satellites with adjustable characteristics, such as linear, quasi-linear, or hard limiter operation. Considering wide bandwidths of the order of 10 MHz in the UHF range, some advantages may be gained by such adjustable characteristics under jamming conditions. The vulnerability of the entire system can be reduced by single channel operation, employing satellites with separate channels covering the entire bandwidth of 10 MHz with multiple base band operation. Among the feasible combined systems are those using UHF and SHF. For tactical satellite systems, a possible configuration comprises a quantity of smaller terminals operating on UHF with a satellite receiving on UHF and retransmitting on SHF to a powerful master surface terminal, acting as net control and relaying the retransmitted signal on SHF to the satellite, which again establishes a UHF link to the desired smaller terminal. Author

N73-10203 Shape Air Defense Technical Center, The Hague (Netherlands).

GROUND TERMINAL MEASUREMENT REQUIREMENTS WITH RESPECT TO SATELLITE COMMUNICATIONS LINK AVAILABILITY

A. N. Ince and A. Wallrabe *In* AGARD Aerospace Telecommun. Systems Aug. 1972 12 p refs (For availability see N73-10187 01-07)

Communications satellite systems are considered with multiple ground terminals carrying many voice channels, linked to each other via a geostationary satellite. To obtain the required link capacities with specified performance it is necessary to set the levels of the assessing carriers very carefully to achieve the appropriate sharing of the satellite output power. The satellite system control center measures link parameters and instructs the ground terminals to adjust transmitter powers in order to counteract the performance degradation due to external factors. The accuracy with which the system parameters can be measured determines how well the carrier levels may be controlled and consequently the availability of the communication links. Measurement methods for some of the most important quantities are given and the accuracy achieved with an experimental satellite terminal is discussed. Author

N73-10204 Admiralty Surface Weapons Establishment, Portsmouth (England).

SCOT SATELLITE COMMUNICATION TERMINAL

P. R. Lees *In* AGARD Aerospace Telecommun. Systems Aug. 1972 4 p (For availability see N73-10187 01-07)

SCOT is the satellite communication terminal in production for the Royal Navy for installation in frigates and certain other classes of ships. It provides broadcast and ship-shore facilities within the SKYNET system. A brief description of the terminal and some of the problems of access and control related to the necessity to fully exploit the terminal's capability are reported.

Author

N73-10205* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FACTORS AFFECTING FREQUENCY AND ORBIT UTILIZATION BY HIGH POWER TRANSMISSION SATELLITE SYSTEMS

Perry W. Kuhns, Edward Miller, and Thomas A. Malley *In* AGARD Aerospace Telecommun. Systems Aug. 1972 16 p refs (For availability see N73-10187 01-07)

The factors affecting the sharing of the geostationary orbit by high power (primarily television) satellite systems having the same or adjacent coverage areas and by satellites occupying the same orbit segment are examined and examples using the results of computer computations are given. The factors considered include: required protection ratio, receiver antenna patterns, relative transmitter power, transmitter antenna patterns, satellite grouping, and coverage pattern overlap. The results presented indicate the limits of system characteristics and orbit deployment which can result from mixing systems. Author

N73-10206 Royal Air Force, Marlow (England).
AUTOMATIC MESSAGE SWITCHING AND DATA TRAFFIC HANDLING IN A MILITARY COMMUNICATIONS NETWORK
C. H. Blanchard *In* AGARD Aerospace Telecommun. Systems Aug. 1972 12 p refs (For availability see N73-10187 01-07)

Computer based message switching systems fulfill a necessary function within a military system, and it is expected that the size and complexity of these highly sophisticated systems will increase. Some of the problems associated with the design, procurement and maintenance of such systems are: Basic fact finding exercises, operational requirement, drafting of a procurement specification, and project definition and tender evaluation. Author

N73-10207 Honeywell Information Systems, Inc., Tampa, Fla.
THE AUTOMATED TECHNICAL CONTROL (ATEC) SYSTEM
Louis Calden and Anthony S. Szalkowski (RADC N. Y.) *In* AGARD Aerospace Telecommun. Systems Aug. 1972 18 p refs (For availability see N73-10187 01-07)

The ATEC system assigns functions to men and machines so that each does most that which they do best. In general, this means machine tasks include the collection, processing, sorting and retrieving of data under the direction of the man whose function includes reasoning, deciding, interpreting, controlling and directing. The overall ATEC design philosophy provides bidirectional modularity for customization to the communication station and graceful degradation in case of failure. Therefore, the total system capability is never lost by failures of even considerable portions of the ATEC. The concept, structure and application of the ATEC system and its subelements are described. Author

N73-10208 Air Force Communications Service, Richards-Gebaur AFB, Mo.
THE TRANSMISSION PERFORMANCE OF THE DEFENSE COMMUNICATIONS SYSTEM
Yuen-sun Fu and Robert L. Ffik *In* AGARD Aerospace Telecommun. Systems Aug. 1972 9 p refs (For availability see N73-10187 01-07)

A system-wide measurement program on the defense communications system was initiated in 1967. The sample plan and measurement procedures are discussed briefly. A summary of the analysis results is presented. It contains estimates of population means for frequency response, delay distortion, impulse noise, idle channel noise and harmonic distortion for the voice channels within the defense communications system. Finally, the 90 percent confidence interval as well as estimates of standard deviation are computed. Author

N73-10209 Electronic Systems Div., L. G. Hanscom Field, Mass.
DIGITAL VERSUS ANALOG COMMUNICATIONS SYSTEMS TECHNICAL AND ECONOMIC CONSIDERATIONS
Carl A. Segerstrom *In* AGARD Aerospace Telecommun. Systems Aug. 1972 10 p (For availability see N73-10187 01-07)

The limitations of the current world-wide analog transmission plant is viewed in terms of its data and voice handling capability. In addition, improved data transmission is highlighted using microwave, cable or tropo, when using digital rather than analog techniques in optimizing information flow. Some of the system improvements expected in using digital switching techniques and the increased possibilities for the inclusion of technical control in the switch designs are discussed from a system viewpoint. Since the current plant represents a large investment and outright replacement of an entire network is impractical, the process of hybridization and eventual all-digital implementation over a 20-30 year interval is examined. Finally some of the possible overall improved system characteristics are listed that cannot now be achieved in the present analog configuration. Author

N73-10210 Lear Siegler, Inc., Grand Rapids, Mich. Instrument Div.
KALMAN FILTERING FOR RAPID AND ACCURATE DETECTION OF CW INTERFERENCE ON DIGITAL TELECOMMUNICATIONS
R. J. Fredericks *In* AGARD Aerospace Telecommun. Systems Aug. 1972 24 p refs (For availability see N73-10187 01-07)

Application of the quasi-linear Kalman filtering algorithm to the problem of estimating the frequency, amplitude and, if desired, initial phase of one or more interfering CW signals is described. These unwanted sinusoids are assumed present in a background of noise and the useful signal bandwidth is assumed to be 20-25 kHz with the jammer(s) located anywhere in this spectral interval. Channel center frequencies located throughout the range 100 kHz to 1000 GHz are investigated without requiring any changes in the basic filter structure. While the state dynamics are linear the measurements are highly non-linear functions of the state variables. Because of the non-linearity in the measurements and the fact that the measurement noise is nonwhite various techniques such as the addition of a fourth variable with the dimensions of hertz to the state vector and the use of an adaptive measurement noise matrix are required to insure proper filter convergence. Results are given showing filter operation with J/N ratios from -9db upwards to over +20db. Typical frequency estimation errors after 1000-2000 microseconds with high J/N ratios are on the order of 10 Hz. Author

N73-10211 Post Office Research Dept., Ipswich (England).
THE EFFECT OF INTERCHANNEL INTERFERENCE ON THE PERFORMANCE OF A PHASE MODULATED DIGITAL SYSTEM
M. C. Davies *In* AGARD Aerospace Telecommun. Systems Aug. 1972 17 p (For availability see N73-10187 01-07)

Computer programs employing simulation and analytical techniques were developed for calculating the error performance of 2- and 4-level coherent-phase-shift keyed (C.P.S.K) and differential-coherent-phase-shift keyed (D.C.P.S.K) systems containing filters of specified characteristics. The effect of these filters on the distortion in the wanted channel, and on the probability density and magnitude of the interference were taken into account. Some preliminary 2-level C.P.S.K results from a versatile experimental test facility are in good agreement with the corresponding theoretical results. Author

N73-10212 Southampton Univ. (England). Dept. of Electronics.
GENERATION OF INTERMODULATION INTERFERENCE DUE TO NON-LINEAR EFFECTS IN THE NEAR FIELD REGIONS OF MULTIPLE TRANSMISSION COMMUNICATION SYSTEM
J. A. Betts and D. R. Ebenezer *In* AGARD Aerospace Telecommun. Systems Aug. 1972 12 p refs (For availability see N73-10187 01-07)

The co-location of transmitters and receivers for military mobile requirements, particularly when a multiple-frequency transmission capability is essential, produces a serious problem of intermodulation interference. The results of a laboratory investigation in which steel specimens have been subjected to two-frequency excitation (mainly in the HF range at 1.2 and 5.1 MHz) of known field strength and orientation are described. Particular attention has been given to the intermodulation level dependence upon surface preparation, which includes machined and polished, serrated, electrodeposited cadmium and cold-sprayed zinc finishes. Results are also described for stainless, alloy and carbon steels. The effect of surface corrosion, which has hitherto been referred to as the rusty-bolt problem, is also described and its effect within an active transmission system has been distinguished from that on parasitic surfaces. Author

N73-10213 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
DIRECTIONAL ANTENNAS FOR A NEW INTERFEROMETER SYSTEM (SIDELOBE SUPPRESSION, PHASE CHARACTERISTICS, SUPPRESSION OF GROUND REFLECTIONS)
H. Oettl and H. Goessl *In* AGARD Aerospace Telecommun. Systems Aug. 1972 8 p refs (For availability see N73-10187 01-07)

A new interferometer system with antennas mounted on El/Az-pedestals is considered. Each antenna consists of an array of 36 crossed dipoles. There is a Tschebyscheff amplitude distribution in the elevation plane and in the plane orthogonal to it. Since the distance between the three interferometer antennas is 57 lambda, the suppression of reflected signals must be better than 40 to 50 db to keep the phase error due to reflections in the order of 0.1 deg. A further method of suppressing ground reflections, i.e. the use of concentric wire-mesh fences around each antenna, is also mentioned. Another error of the antenna system is the phase pattern discrepancies between

antennas, due to the actual amplitude and phase values of the dipoles differing from the designed values. This error only arises for low satellite orbits a few degrees off the zenith, when the antennas are steered in the elevation axis only. Author

N73-10214*# Auburn Univ., Ala. Satellite Communications Lab.
TELEVISION BROADCAST RELAY SYSTEM, VOLUME 2
E. R. Graf [1972] 107 p refs
(Contract NAS8-24818)
(NASA-CR-123909) Avail: NTIS HC $7.50 CSCL 09F

A statistical analysis of propagation characteristics at 12 GHz for the design of a worldwide communication satellite system is reported. High power spaceborne TV transmitter design and the development of a low cost, low noise ground receiver for domestic reception are considered most important for implementation of a TVBS system. Author

N73-10215*# Lockheed Electronics Co., Houston, Tex.
DIFFERENTIAL PHASE SHIFT KEYED COMMUNICATION SYSTEM Patent Application
Phillip M. Hopkins and Wally M. Wallingford, inventors (to NASA)
Filed 12 Oct. 1972 27 p
(Contract NAS9-10950)
(NASA-Case-MSC-14065-1; US-Patent-Appl-SN-297128) Avail: NTIS HC $3.50 CSCL 17B

A communication system for transmitting differential phase-shift-keyed signals (DPSK) formed from input data bits without requirement of timing or phase reference signals is described. The system includes a transmitter which sends the phase-shift-keyed signals over a telephone or telegraph wire or on a subcarrier in an RF communication system to a receiver. The transmitter includes a carrier source oscillator which provides a carrier signal of predetermined frequency to a modulator. An encoder responds to incoming input data bits and forms a phase increment signal which is modulated onto the carrier by the modulator in accord with the input data bits and sent to the receiver. The bits of Channel 1 and Channel 2 which may be from two separate channels of data, or which may be two serial bits from a single data bit stream in parallel format are synchronized by clock pulses. The encoder compares the incoming data bits for each successive transmission interval with the phase increment signal for the preceding transmission interval to form the next phase increment signal. NASA

N73-10216*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AMPLITUDE FADING OF SIMULTANEOUS TRANSIONOSPHERIC L-BAND AND VHF SIGNALS RECEIVED AT THE GEOMAGNETIC EQUATOR
W. B. Sessions (Westinghouse Electric Corp.) Jun. 1972 23 p refs
(NASA-TM-X-66060; X-810-72-282) Avail: NTIS HC $3.25 CSCL 20N

At Ancon, Peru, simultaneous observations of 1550-MHz and 136-MHz signals from the ATS 5 and Intelsat-1 spacecraft showed ionospheric fading as great as 27 db at 136 MHz and 6 db at 1550 MHZ. The observations were made on 48 days during the 1970 autumnal and 1971 vernal equinox periods. Comparison of the two frequencies, in respect to rates and depths of fades, is made. Statistical distributions of the received signal levels during ionospheric scintillation occurrences are presented which may be of use to communications system engineers with operational requirements in the equatorial regions. The distributions show that during expected periods of scintillation, the L band signal typically falls 1.1 db below the median for 1.0 percent of the time, and the VHF signal falls 11.5 db below the median for 1.0 percent of the time. Author

N73-10217*# Virginia Polytechnic Inst. and State Univ., Blacksburg.
THE INFLUENCE OF POLARIZATION ON MILLIMETER WAVE PROPAGATION THROUGH RAIN Semiannual Status Report, 1 Jan. - 30 Jun. 1972
C. W. Bostian and W. L. Stutzman 1 Jul. 1972 49 p
(Grant NGR-47-004-091)
(NASA-CR-130107; SASR-1) Avail: NTIS HC $4.50 CSCL 20N

A program for the measurement and analysis of the depolarization and differential attenuation that occur when millimeter wave signals propagate through rain is described. Initial data are taken along a 1.43 km path at 17.65 GHz and a supporting theoretical model is developed to relate the propagation effects to rainfall rate and wind velocity. A block diagram of the overall experiment is included. It consists of: (1) an RF system (millimeter wave transmitter and receiver), (2) transmitting and receiving antennas, (3) a weather system with rain gauges, wind sensors, and drop counters, and (4) a digital control, processing, and data storage system. Author

N73-10218*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADIO WAVE SCINTILLATIONS AT EQUATORIAL REGIONS
A. D. Poularikas (Rhode Island Univ.) Jun. 1972 35 p refs
(NASA-TM-X-66074; X-810-72-287) Avail: NTIS HC $3.75 CSCL 20N

Radio waves, passing through the atmosphere, experience amplitude and phase fluctuations know as scintillations. A characterization of equatorial scintillation, which has resulted from studies of data recorded primarily in South America and equatorial Africa, is presented. Equatorial scintillation phenomena are complex because they appear to vary with time of day (pre-and postmidnight), season (equinoxes), and magnetic activity. A wider and more systematic geographical coverage is needed for both scientific and engineering purposes; therefore, it is recommended that more observations should be made at earth stations (at low-geomagnetic latitudes) to record equatorial scintillation phenomena. Author

N73-10219# Georgia Inst. of Tech., Atlanta.
FUSED SILICA REQUIREMENTS FOR SLIP CASTING RADOMES
Joe N. Harris and Earle A. Welsh Jun. 1972 22 p ref
(Contract N00017-70-C-4438)
(AD-745332; GIT-A-1246-TR-1) Avail: NTIS CSCL 17/9

The report consists of a material specification for a fused silica casting slip. The rationale behind the requirements for this specification is given. Author (GRA)

N73-10220# Admiralty Surface Weapons Establishment, Portsmouth (England).
THE CALCULATION OF QUADRATIC FORMS FOR TURN DETECTOR
A. L. C. Quigley Mar. 1972 10 p refs
(AD-744582; ASWE-TR-72-10; BR-29419) Avail: NTIS CSCL 12/2

The Kalman filter equations contain terms for an expression known as the quadratic form. This expression provides a useful criterion for deciding whether the target being tracked by the Kalman filter has maneuvered. This note shows that the value of the quadratic form is, in certain circumstances, independent of the precise time for which it is calculated. Author (GRA)

N73-10221# Defence Research Information Centre, Orpington (England).
DIFFRACTION OF RADIO WAVES AROUND THE EARTH'S SURFACE
V. Fock Apr. 1972 31 p refs Transl. into ENGLISH from Zh. Eksperim. i Teor. Fiz. (Moscow), v. 15, 1945 p 479-496
(AD-742108; DRIC-Trans-2747; DRIC-BR-30122) Avail: NTIS CSCL 20/14

Contents: Statement of the problem and its solution in series form; Summation formula; Calculation of the Hertz function for the illuminated regions; Asymptotic expressions for the Hankel function; Expression of the Hertz function applicable to the twilight regions (penumbrae); Study of the expression for the Hertz function; Summary of results. Author GRA

N73-10222# Army Materiel Systems Analysis Agency, Aberdeen Proving Ground, Md.
A MODEL FOR TELETYPE COMMUNICATIONS EVALUATION
Larry F. Shanok and Newell E. Quinton Apr. 1972 48 p
(AD-744467; AMSAA-TM-135) Avail: NTIS CSCL 17/2

The report describes an analytic model for the evaluation of

teletype communication networks. The queueing model determines average delay by priority category for both full duplex teletype channels. The main body of the report provides the general concept of the model. The appendices must be read to gain the knowledge needed to exercise the model. The computer program is included. The model is particularly useful in ill-defined situations requiring the evaluation of many alternatives. Author (GRA)

N73-10223# Naval Postgraduate School, Monterey, Calif.
A STUDY OF DELAY LINES AND THE DEVELOPMENT OF DESIGN CRITERIA FOR HF COMMUNICATIONS RECEIVER NOISE BLANKERS M.S. Thesis
Ozden Berkan Sep. 1971 73 p refs
(AD-745184) Avail: NTIS CSCL 09/1

Atmospheric and man-made disturbances which result in noise pulses of random amplitude and randomly spaced in time have long been experienced in the communications field. Design features of an RF blanker for this type of noise are investigated. The specifications of functional blocks are established. One of the functional blocks of an RF blanker is a linear delay line. The main features and design methods for passive delay lines are investigated. An active RC circuit to realize the delay function is proposed. This network and another are constructed and their characteristics obtained. Author (GRA)

N73-10224# Texas Univ., Austin. Applied Research Labs.
A DIGITAL BEAMFORMER FOR NARROWBAND SONAR SYSTEMS
S. Patrick Pitt, W. Thomas Adams, and J. Kenneth Vaughan 3 Apr. 1972 115 p refs
(Contract N00024-72-C-1008; SF Proj. 11121106; SF Proj. 11121104)
(AD-745302; ARL-TR-72-3) Avail: NTIS CSCL 17/1

Near the end of 1968, the study of geometric quantization of input data for digital replica correlation led to the concept of a digital beamformer using the same technique. Geometric A/D (GAD) provides a wide digital dynamic range with a small number of bits. Such a beamformer was proposed, using quadrature sampling and digital phase shifting to approximate desired time delays. A computer simulation was used to determine feasibility and, as a result, a particular version applicable to narrowband systems using cylindrical arrays was implemented and tested. Results show that such a system provides a good approximation to a fully linear, phase shift beamformer. Author (GRA)

N73-10225# Naval Underwater Systems Center, Newport, R.I.
ESTIMATION OF THE MAGNITUDE-SQUARED COHERENCE FUNCTION (SPECTRUM)
G. Clifford Carter 19 May 1972 107 p refs
(AD-743945; NUSC-TR-4343) Avail: NTIS CSCL 09/4

A method of estimating the magnitude-squared coherence function (spectrum) for zero-mean processes that are wide-sense stationary and random is presented. The estimation technique uses the weighted overlapped segmentation fast Fourier transform (FFT) approach. Analytical and empirical results for statistics of the estimator are presented for the processes. Analytical expressions are derived in the nonoverlapped case. Empirical results show a decrease in bias and variance of the estimator with increasing overlap and suggest that a 50-percent overlap is highly desirable when cosine (Hanning) weighting is used. Author (GRA)

N73-10226# Harry Diamond Labs., Washington, D.C.
RESPONSE OF AN AIRBORNE-SHORT-PULSE RADAR TO CHAFF
James E. Seltzer Apr. 1972 54 p refs
(DA Proj. 1B2-62301-A-208; HDL Proj. LCM14)
(AD-744776; HDL-TR-1590) Avail: NTIS CSCL 17/4

Radar backscatter from a chaff cloud is examined for the case in which the radar approaches the cloud from above and moves into and through the cloud. The chaff cloud is modelled as a collection of randomly oriented dipoles having a mean volume density that is a function of altitude but invariant in a horizontal plane. The statistics of the chaff echo power when the number of dipoles in the resolution volume is large are reviewed. The impulse response, which approximates the short-pulse radar response, and the radar return signal for a specific range resolution cell as a function of the position of the radar relative to the cloud are derived for several chaff cloud configurations and antenna patterns. Power spectral density functions for range-gated chaff-return signals and correlation functions for the signals following square-law detection are also derived. Author (GRA)

N73-10227# Pennsylvania Univ., Philadelphia. Moore School of Electrical Engineering.
RESEARCH ON THE ESTIMATION OF TRAJECTORIES FROM RADAR DATA Quarterly Progress Report, 1 Nov. 1971 - 31 Jan. 1972
Raymond S. Berkowitz, M. Plotkin, D. B. Luber, and S. Gottesman Apr. 1972 36 p refs
(Contract DAAB07-71-C-0212; DA Proj. 1S6-63719-DK-02)
(AD-745421; ECOM-0212-3; Rept-72-25; QPR-3) Avail: NTIS CSCL 17/9

The general purpose of the work reported is to obtain the best possible feasible signal processing algorithms for estimating from radar data characteristics and trajectory parameters of bodies moving in the air. The report starts with an extensive set of numerical results showing the effectiveness of the simplified dynamics equations evolved in approximating pertinent characteristics of trajectories calculated by the BRL point-mass model. Next, a mathematical derivation of the optimal recursive algorithm for filtering and smoothing radar data, formulation for which was presented in the previous Quarterly Progress Report, is presented. A technique for evaluation of recursive filtering-smoothing algorithms by deterministic calculations is then presented. Author (GRA)

N73-10228# Connecticut Univ., Storrs. Dept. of Speech.
IMPROVEMENTS IN UNDERWATER VOICE COMMUNICATION Final Report, 1 Jan. 1968 - 15 Sep. 1971
Harry S. Cooker 1 Apr. 1972 12 p refs
(Contract N00014-68-A-0197-0001)
(AD-745794; UCONN-IUVC/ONR-8) Avail: NTIS CSCL 17/2

Various methods and techniques were investigated for improving voice communication between diver/swimmers, within closed environments, and under adverse conditions resulting from water immersion. Improvements were sought in the reduction of channel noise, increased signal reception, reduced gas/pressure distortion, expansion of the useful auditory channel, and clearer diver/swimmer articulation. In order to accomplish these tasks, it was necessary to develop methodologies for better assessment of transducers and transmission channels. Furthermore, studies were conducted to determine the effect of word sequencing on message reception and the effect of time/frequency distortion on the transmission of prosodic feature information. Author (GRA)

N73-10229# Georgia Inst. of Tech., Atlanta.
PROCESSING REQUIREMENTS FOR SLIP-CAST FUSED SILICA RADOMES
Joe N. Harris and Earle A. Welsh Jun. 1972 32 p refs
(Contract N00017-70-C-4438)
(AD-745793; GIT-A-1246-TR-2) Avail: NTIS CSCL 17/9

The report consists of a process specification for slip-cast fused silica radomes. The rationale behind the requirements for this specification is given. Author (GRA)

N73-10230# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
ACCEPTANCE CRITERIA FOR SLIP-CAST FUSED SILICA RADOMES
Joe N. Harris and Earle A. Welsh Jun. 1972 27 p refs
(Contract N00017-70-C-4438)
(AD-745743; GIT-A-1246-3) Avail: NTIS CSCL 17/9

The report consists of an acceptance criteria specification for slip-cast fused silica radomes. The rationale behind the requirements for this specification is given. Author (GRA)

N73-10231# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
BIBLIOGRAPHY ON DIGITAL IMAGE PROCESSING AND RELATED TOPICS
Feb. 1972 267 p refs
(Contract F08606-72-C-0008; ARPA Order 1706)
(AD-745790; USCEE-410) Avail: NTIS CSCL 09/4

The bibliography contains references to books, reports, and other publications on the general subject of digital image processing and related topics. It is arranged into three sections: classification by subject; classification by last name of first author; classification by year of publication. Over 1,000 entries are included in the bibliography. Author (GRA)

N73-10832* Smithsonian Astrophysical Observatory, Cambridge, Mass.
DESCRIPTION OF EIGHT STATION RADAR NEAR HAVANA, ILLINOIS
Richard B. Southworth *In its* Meteor Res. Program Sep. 1972 p 19-27 refs (For availability see N73-10830 01-30)
CSCL 17I

N73-10833* Smithsonian Astrophysical Observatory, Cambridge, Mass.
SIMULTANEOUS OBSERVATIONS BY TELEVISION CAMERA AND RADAR
Richard E. McCrosky and J. T. Williams *In its* Meteor Res. Program Sep. 1972 p 29-36 (For availability see N73-10830 01-30)
CSCL 09E

N73-10834* Smithsonian Astrophysical Observatory, Cambridge, Mass.
ANTENNA CALIBRATION AT HAVANA
Zdenek Sekanina and Richard B. Southworth *In its* Meteor Res. Program Sep. 1972 p 37-50 (For availability see N73-10830 01-30)
CSCL 09E

N73-10835* Smithsonian Astrophysical Observatory, Cambridge, Mass.
ANALYSIS PROCEDURE FOR RADAR OBSERVATIONS
Richard B. Southworth *In its* Meteor Res. Program Sep. 1972 p 51-68 refs (For availability see N73-10830 01-30)
CSCL 17I

N73-10836* Smithsonian Astrophysical Observatory, Cambridge, Mass.
ANALYSIS PROCEDURE FOR TELEVISION OBSERVATIONS AND SIMULTANEOUS OBSERVATIONS
Allan F. Cook, II *In its* Meteor Res. Program Sep. 1972 p 69-76 ref (For availability see N73-10830 01-30)
CSCL 09F

N73-10838* Smithsonian Astrophysical Observatory, Cambridge, Mass.
RESULTS FROM SIMULTANEOUS RADAR-TELEVISION OBSERVATIONS
Allan F. Cook, II, J. T. Williams, and C.-Y. Shao *In its* Meteor Res. Program Sep. 1972 p 83-99 refs (For availability see N73-10830 01-30)
CSCL 17I

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N73-10232*# System Development Corp., Huntsville, Ala.
ATM EXPERIMENT S-056 IMAGE PROCESSING REQUIREMENTS DEFINITION
15 Sep. 1972 77 p refs
(Contract NAS8-25471)
(NASA-CR-123911; TM-(L)-HU-033/007/00) Avail: NTIS HC $6.00 CSCL 09B

A plan is presented for satisfying the image data processing needs of the S-056 Apollo Telescope Mount experiment. The report is based on information gathered from related technical publications, consultation with numerous image processing experts, and on the experience that was gained in working on related image processing tasks over a two-year period. Author

N73-10233# Central Electricity Generating Board, London (England).
ON-LINE COMPUTERS IN POWER STATIONS, 1960 - JUNE 1972
M. W. Jervis Aug. 1972 22 p refs
(CE-Bib-226) Avail: NTIS HC $3.25

The bibliography includes references for nuclear and thermal stations located in the U.S., U.K., West Germany, France, and Canada. D.L.G.

N73-10234*# Radio Corp. of America, Camden, N.J. Advanced Technology Labs.
C-MOS ARRAY DESIGN TECHNIQUES: SUMC MULTIPROCESSOR SYSTEM STUDY Technical Report, Jan. - Mar. 1972
W. A. Clapp, W. A. Helbig, and A. S. Merriam May 1972 162 p refs
(Contract NAS12-2233)
(NASA-CR-128395) Avail: NTIS HC $10.25 CSCL 09B

The current capabilities of LSI techniques for speed and reliability, plus the possibilities of assembling large configurations of LSI logic and storage elements, have demanded the study of multiprocessors and multiprocessing techniques, problems, and potentialities. Evaluated are three previous systems studies for a space ultrareliable modular computer multiprocessing system, and a new multiprocessing system is proposed that is flexibly configured with up to four central processors, four I/O processors, and 16 main memory units, plus auxiliary memory and peripheral devices. This multiprocessor system features a multilevel interrupt, qualified S/360 compatibility for ground-based generation of programs, virtual memory management of a storage hierarchy through I/O processors, and multiport access to multiple and shared memory units. Author

N73-10235*# Intermetrics, Inc., Cambridge, Mass.
ENGINEERING STUDY FOR THE FUNCTIONAL DESIGN OF A MULTIPROCESSOR SYSTEM Final Report
James S. Miller, Woodrow H. Vandever, Saul F. Stanten, Arra E. Avakian, and Alex L. Kosmala Sep. 1972 474 p
(Contract NAS9-11745)
(NASA-CR-1285601; TR-14-72) Avail: NTIS HC $25.75 CSCL 09B

The results are presented of a study to generate a functional system design of a multiprocessing computer system capable of satisfying the computational requirements of a space station. These data management system requirements were specified to include: (1) real time control, (2) data processing and storage, (3) data retrieval, and (4) remote terminal servicing. Author

N73-10236# National Bureau of Standards, Washington, D.C. Information Processing Technology Div.
A UNIVERSAL DROPOUT TESTER FOR MAGNETIC STORAGE MEDIA
Sidney B. Geller Sep. 1972 32 p refs
(NBS-TN-739) Avail: SOD $0.35 as C13.46:739

A signal dropout detection and counting system is described which was designed to make measurements on 1/2 inch magnetic computer tape, magnetic instrumentation tapes and magnetic cassette tapes as required by existing and potential Federal Specifications. The calibration and operational procedures for the system are described in detail. Author

N73-10237*# Scientific Translation Service, Santa Barbara, Calif.
PROGRAMMING LANGUAGES: A BRIEF REVIEW
F. Marsing Washington NASA Oct. 1972 12 p refs Transl. into ENGLISH from Elektron. (West Ger.), v. 21, Jun. 1972 p 213-216
(Contract NASw-2035)
(NASA-TT-F-14610) Avail: NTIS HC $3.00 CSCL 09B

Brief descriptions are given of the most important and most commonly used programming languages and their ranges of applicability. The advantages of programming into a special programming language and then into computer language rather than directly into computer language are illustrated. Brief descriptions are given of system-dependent and problem-oriented (or system-independent) programming languages. In the case of the problem-oriented languages a distinction is made between programming languages for commercial problems and

programming languages for mathematical and technical problems. Included in the latter group are the well-known ALGOL and FORTRAN programming languages. Author

N73-10238*# Avco Corp., Wilmington, Mass.
ADAPTION OF A CORRECTOR MODULE TO THE IMP DYNAMICS PROGRAM Final Report and User's Manual
Sep. 1972 103 p refs
(Contract NAS5-11881)
(NASA-CR-130108; AVSD-0335-72-RR) Avail: NTIS HC $7.25 CSCL 09B

The corrector module of the RAEIOS program and the IMP dynamics computer program were combined to achieve a date-fitting capability with the more general spacecraft dynamics models of the IMP program. The IMP dynamics program presents models of spacecraft dynamics for satellites with long, flexible booms. The properties of the corrector are discussed and a description is presented of the performance criteria and search logic for parameter estimation. A description is also given of the modifications made to add the corrector to the IMP program. This includes subroutine descriptions, common definitions, definition of input, and a description of output. Author

N73-10239# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
DEVELOPMENT OF INTEGRATED MAGNETIC STORAGE DEVICES Final Report [DEVELOPPEMENT DES MEMOIRES MAGNETIQUES INTEGREES. COMPTE RENDU FINAL]
M. L. Carbonel 19 May 1970 10 p In FRENCH
(Contract DegInf-69.02.089.00.212.75.01)
Avail: NTIS HC $3.00

A report is presented on the feasibility of manufacturing high capacity magnetic storage devices. Three main aspects are discussed: manufacturing technology, interconnections, and electronic coupling. A vapor-deposited copper layer was used as a base for manufacturing plates with a capacity of 256 72-bit words. The best photosensitive resin to use is discussed. The copper layer was placed on a Mylar sheet with the gold connectors and hot-pressed. Difficulties were met by tearing off the copper substrate. Interconnections between several layers and with output leads were analyzed. An electric and a magnetic tester were used to test the devices. Author (ESRO)

N73-10240# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
PROCEEDINGS OF THE EASTERN SIMULATION COUNCIL MEETING OF DEVELOPMENT OF COMPUTER TECHNOLOGY FOR SIMULATION
R. B. McDowell, A. G. Witte, N. K. Brown, P. F. Bohn, and D. M. White Apr. 1971 162 p refs Meeting held at Silver Spring, Md., 25 Mar. 1971
(Contract N00017-62-C-0604)
(AD-743937; APL-TG-1153) Avail: NTIS CSCL 09/2

The five papers in the document describe a multiple-computer system resulting from a relatively new trend at the Applied Physics Laboratory away from individual, stand-alone computers and toward the interconnection of computers. The initial impetus for this trend was to gain economy of scale and to slow the rapid proliferation of computers dedicated to specific jobs. This new emphasis has required the development of technology for combining real-time and multiprogramming modes of operation. This will enable a system of interdependent computers to provide simultaneous hybrid simulation, interactive digital simulation, hardware tie-ins to these simulations, a wide variety of on-line terminal operations, and batch processing. The system software and hardware links necessary to implement such a multiple computer system are discussed in detail. Author (GRA)

N73-10241# Iowa Univ., Iowa City. Dept. of Mathematics.
EASILY TESTABLE REALIZATIONS FOR LOGIC FUNCTIONS
Sudhakar M. Reddy May 1972 36 p refs
(Contract N00014-68-A-0500)
(AD-745720; TR-54) Avail: NTIS CSCL 09/2

Several techniques to realize networks for n-variable logic functions are given such that the fault detecting sets (under the assumption that single gates are faulty) have (n + 4) members and also these fault detecting sets are independent of the function being realized. These networks use two input exclusive OR gates and AND gates. Techniques to design networks with devices realizing m-input even parity functions and AND gates are also given which require fault detecting test sets, that are independent of the function being realized, with (n + (2 to the mth power)) members. Techniques to design the checker and the network to generate the test sets are also given. Author (GRA)

N73-10242# Douglas Aircraft Co., Inc., Santa Monica, Calif.
INVESTIGATION OF AERODYNAMIC ANALYSIS PROBLEMS IN TRANSONIC MANEUVERING. VOLUME 2: AIRFOIL ANALYSIS COMPUTER PROGRAM Final Report, Jun. 1970 - Aug. 1971
Arvel E. Gentry Sep. 1971 310 p refs
(Contract N00014-70-C-0400; NR Proj. 212-199)
(AD-740124; MDC-J5264-02-Vol-2) Avail: NTIS CSCL 09/2

The report describes a computer program designed to facilitate the analysis of mono- and multi-element airfoils at subsonic flight conditions with attached flow. This program is a consolidation of several existing computer programs so that they are compatible, have standard interfaces, and operate together as one very large program. This program includes a potential flow analysis, supercritical pressure calculations, and boundary layer calculations using either a finite-difference method or an integral method. Application studies using this program are described in Volume 1 of this report. Author (GRA)

N73-10243# RAND Corp., Santa Monica, Calif.
DATA RECONFIGURATION SERVICE COMPILER: COMMUNICATIONS AMONG HETEROGENEOUS COMPUTER CENTERS USING REMOTE RESOURCE SHARING
E. F. Harslem, J. Heafner, and T. D. Wisniewski Apr. 1972 125 p refs
(Contract DAHC15-67-C-0141; ARPA Order 189-1)
(AD-745751; R-887-ARPA) Avail: NTIS CSCL 09/2

The report describes the use, implementation, and maintenance procedures for the Data Reconfiguration Service (DRS) Compiler which is coded in PL/1. The report provides an overview of the language in which data-reconfiguration definitions are expressed. Syntax is stated in a formal notation. GRA

N73-10244# California Univ., Los Angeles. Dept. of Computer Science.
COMPUTER NETWORK RESEARCH Semiannual Technical Report, 1 Jan. - 30 Jun. 1972
Leonard Kleinrock, Gerald Estrin, Michel Melkanoff, and Richard R. Muntz 30 Jun. 1972 116 p refs
(Contract DAHC15-69-C-0285; ARPA Order 1380)
(AD-746509) Avail: NTIS CSCL 09/2

The Semiannual Technical Report covers the period January 1 through June 30, 1972. Activities have concentrated on computer systems studies and computer-communication network studies. The report discusses the results from modeling, analysis and measurement of various aspects of computer systems behavior and for networks, and presents some specific results for the ARPA Network. Author (GRA)

N73-10191 Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
COMPUTER AIDED EVALUATION OF RECONNAISSANCE IMAGE COMPRESSION SCHEMES USING AN ON-LINE INTERACTIVE FACILITY
J. C. Mott-Smith, F. H. Cook, and J. M. Knight (Mitre Corp., Bedford, Mass.) *In* AGARD Aerospace Telecommun. Systems Aug. 1972 20 p refs (For availability see N73-10187 01-07)
(Contract F19628-71-C-0002)

N73-10198 Mitre Corp., Bedford, Mass.
A FLEXIBLE HARDWIRED FAST FOURIER TRANSFORM DIGITAL PROCESSOR
E. A. Palo and G. C. O'Leary *In* AGARD Aerospace Telecommun. Systems Aug. 1972 15 p refs (For availability see N73-10187 01-07)
(Contract F19628-71-C-0002)

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N73-10245# Physics Lab. RVO-TNO, The Hague (Netherlands).
A PRINT OUT CONVERTER PRICO-03
A. Bruin Jan. 1972 84 p In DUTCH; ENGLISH summary
(Ph-L-1972-4) Avail: NTIS HC $6.25

A description of an apparatus designed to print numbers, coming from eight electronic time interval measuring apparatuses, is presented. A serial number and the time are added to each group of eight numbers. The printing is done by an electric typewriter, an electric adding-machine and a teleprinter, which also provides a paper tape. The apparatus consists of a 19 inch console which contains the converter. Author

N73-10246# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
CAMAC: A MODULAR INSTRUMENTATION SYSTEM FOR DATA HANDLING: REVISED DESCRIPTION AND SPECIFICATION
1972 65 p
(EUR-4100-e-Rev-1972) Avail: NTIS HC $5.25

The CAMAC modular data handling system is used with on-line digital computers. It is based on a digital highway for data and control. The CAMAC specification ensures compatibility between equipment from different sources. Author

N73-10247# Magnetic Corp. of America, Cambridge, Mass.
LIGHTWEIGHT SUPERCONDUCTING MHD MAGNETS. VOLUME 1: SADDLE MAGNET DESIGN, CONSTRUCTION AND PRELIMINARY TEST RESULTS Final Report, May 1970 - Mar. 1972
Richard J. Thome and John J. Stekly Jun. 1972 258 p
(Contract F33615-70-C-1567; AF Proj. 3145)
(AD-745321; AFAPL-TR-72-32-Vol-1) Avail: NTIS CSCL 09/1

This is the final report for the development of a superconducting magnet system for magnetohydrodynamic power generation. The information is presented in two volumes. Volume 1 describes the magnet development effort from the initial parametric analyses through design and supporting experimentation to the preliminary testing of the magnet in a vertical bucket type dewar.
Author (GRA)

N73-10248*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AUTOMATIC VEHICLE LOCATION SYSTEM Patent Application
George R. Hansen, Jr., inventor (to NASA) Filed 5 Oct. 1971 31 p
(Contract NAS7-100)
(NASA-Case-NPO-11850-1; US-Patent-Appl-SN-186700) Avail: NTIS HC $3.75 CSCL 09E

A vehicle detection system in which all active elements are carried by the moving vehicles is described. The system includes passive loops, arranged in a sequence at each location. Each loop is tuned to a chosen frequency so that the sequence of frequencies, defined by the loop sequence at each location, represents a location code. Each vehicle carries a transmitter which transmits all the loop frequencies. It also carries a receiver which is coupled by each loop to receive only the frequency to which the loop is tuned. The sequence of the received frequencies represents the code of the location being traversed, and is stored in a data register for transmission to a control or monitoring center. NASA

N73-10249*# Washington Univ., St. Louis, Mo. Center for Development Technology.
A WIDEBAND 12 GHz DOWN CONVERTER
Burton A. Newman and Fred J. Rosenbaum Sep. 1972 115 p refs
(Grant NGL-26-008-054)
(NASA-CR-128394; Rept-(R)T-72/2) Avail: NTIS HC $7.75 CSCL 09E

The design, fabrication, and evaluation of a single ended 12 GHz down-converter suitable for use in a low cost satellite ground terminal is described. The mixer uses waveguide, coaxial and MIC (microwave integrated circuit) transmission line components. Theoretical and experimental analyses of several microstrip circuit elements are presented including the traveling wave-directional filter, quarter wave-length proximity directional coupler, low pass filter and the quarterwave band stop filter. The optimum performance achieved for the mixer using a packaged diode was 9.4 db conversion loss and a bandwidth of 275 MHz. Author

N73-10250*# Hughes Aircraft Co., Torrance, Calif. Electron Dynamics Div.
DEVELOPMENT OF AN ENGINEERING MODEL TRAVELING WAVE TUBE AMPLIFIER FOR SPACE COMMUNICATION SYSTEMS Final Report
C. M. Eallonardo, J. Songli, and A. Basiulis Nov. 1972 116 p
(Contract NAS1-10417)
(NASA-CR-112125; EDD-W-3895) Avail: NTIS HC $8.00 CSCL 09E

A design has been made of a 100 watt traveling-wave tube amplifier for use in space communication applications. The features of very high overall efficiency and heat rejection of waste heat at low thermal densities were predominant in the design concept. The design concept was proven by building a series of tubes, operating at efficiencies up to 50%. These tubes utilized heat pipe cooling and heat distribution such that 150 watts of waste heat was rejected at a density of less than 1.5 watts per square inch. A power supply to convert a 28 volt primary line of the needs of the TWT was built and operated at 85% efficiency.
Author

N73-10251*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SYSTEM EFFICIENCY OF A MICROWAVE POWER TUBE WITH A MULTISTAGE DEPRESSED COLLECTOR
James A. Dayton, Jr. Washington Nov. 1972 29 p refs
(NASA-TM-X-2651; E-7057) Avail: NTIS HC $3.00 CSCL 09E

The efficiencies of a microwave power tube with a multistage depressed collector and of the power supply driving the tube are computed. An analytical expression for the collector efficiency, which includes the effect of secondary emission and the radial component of velocity, is derived for a hypothetical current probability distribution function. In addition, collector efficiency is calculated with the aid of a digital computer for a specific current distribution. The efficiency of the power supply required to operate the tube in a space environment is estimated by using a simple parallel inverter system. Author

N73-10252*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ADAPTIVE FILTERING WITH CORRELATED STATE NOISE
P. Argentiero Oct. 1972 26 p refs Submitted for publication
(NASA-TM-X-66080; X-551-72-394) Avail: NTIS HC $3.50 CSCL 09A

An adaptive filter which uses a minimum variance criteria to estimate state noise covariance is presented. It is not necessary to assume white state noise in order to implement the filter. Simulation results are given which demonstrate that the filter tracks a satellite in the presence of modeling errors better than a conventional minimum variance filter with state noise. It is also shown that the propagated convariance matrix of the filter is an accurate indicator of the filter's performance. Author

N73-10253# Admiralty Surface Weapons Establishment, Portsmouth (England).
AN INVESTIGATION INTO THE CROSSTALK BETWEEN CABLES AS USED IN A TYPICAL NAVAL ENVIRONMENT
R. J. Plunkett Feb. 1972 65 p refs
(AD-742971; ASWE-TR-72-8; BR-29214) Avail: NTIS CSCL 09/1

The coupling characteristics of a number of commonly used cables in a number of configurations has been investigated. In the case of two similar braided coaxial cables the coupling has also been calculated as well as measured. Author (GRA)

N73-10254# Navy Clothing and Textile Research Unit, Natick, Mass.
DEVELOPMENT AND EVALUATION OF INERTIAL MICROPHONE HEADSET SYSTEM

Norman F. Audet, Arthur H. Chadwick, and Alan Hofer Jun. 1972 35 p refs
(AD-745088; Rept-12-71) Avail: NTIS CSCL 09/1

An inertial microphone (bone conduction) headset communication device was developed for use with a damage control suit system (DCSS) to provide two-wire telephone contact between ship damage control and the system operator over sound-powered communication links on Navy ships. The headset was designed to be compatible with existing sound-powered telephone equipment. Evaluation results are reported. Author (GRA)

N73-10255# Microwave Applications Group, Chatsworth, Calif.
MICROWAVE RECIPROCAL LATCHING FERRITE PHASE SHIFTERS Final Report, 15 Sep. 1971 - 15 Jun. 1972
Russell A. Gaspari and Charles R. Boyd, Jr. Ft. Monmouth, N. J. ECOM Jun. 1972 96 p refs
(Contract DAAB07-71-C-0112; MAG Proj. J10-010)
(AD-744795; ECOM-0112-2) Avail: NTIS CSCL 09/5

In the search for small size, low cost, reciprocal latching microwave phase shifters, two promising designs were brought to the developmental prototype stage. Each employs a dual mode principle in which contra-rotating senses of circular polarization are subjected to controlled phase delay for opposing directions of propagation. In the first design, the dual mode propagating structure is a ridged waveguide with four equally spaced ridges to maintain double reflection symmetry. In the second design, the dual mode propagating structure is a combination balanced slotline and balanced microstrip both deposited with mutual interaction region within a ferrimagnetic substrate. Author (GRA)

N73-10256# Naval Postgraduate School, Monterey, Calif.
COMPUTER MODELS FOR ELECTRONIC COMPONENTS WITH AND WITHOUT TEMPERATURE EFFECTS M.S. Thesis
Nejat Gueldiken Dec. 1971 75 p refs
(AD-745189) Avail: NTIS CSCL 09/5

Whenever active or passive devices are included in an electronic circuit that is to be analyzed by a computer, appropriate models for these devices must be developed. The majority of the models that have been adapted for analyzing a circuit on a computer have neglected the effect of ambient temperature on the element. Temperature variation has been shown to have hazardous effects on electronic components. The paper deals with the modification of some existing models to include temperature effects and shows the results of such modifications. It is done for six basic electronic components (i.e., resistor, capacitor, inductor, diode, bipolar transistor and field-effect transistor). Suggestions for extension of this work are also included. Author (GRA)

N73-10257# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COUPLED OPERATIONAL AMPLIFIER CIRCUITS FOR CURRENT SIGNALS
W. Kriesel and M. Dobrowolny 23 Mar. 1972 11 p Transl. into ENGLISH from Messen, Steuern, Regeln (Berlin), v. 14, no. 3, 1971 p 58-60
(AD-743690; FTD-HC-23-2071-71) Avail: NTIS CSCL 09/5

It is shown that for the analog signal output of digital devices one mostly uses impressed currents formed by feedback operational amplifiers. The paper deals with the calculation of such circuits, in particular the wiring for current signals and the arising coupling between several operational amplifiers one with the other. The influence of the errors due to the coupling is determined, the treatment being carried out in the control engineer's way. Author (GRA)

N73-10258# International Business Machines Corp., Oswego, N.Y. Electronics Systems Center.
DEFORMOGRAPHIC STORAGE DISPLAY TUBE (DSDT) MATERIAL STUDY Technical Report, Jul. 1971 - Mar. 1972
Bernard I. Halperin 15 Jun. 1972 69 p refs
(Contract N00014-71-C-0270; NR Proj. 215-186)
(AD-744689; IBM-72-560-0002) Avail: NTIS CSCL 09/1

The report describes the investigation into the problem of finding a polymer material to serve as the deformable medium for a light valve display device called the Deformographic Storage Display Tube (DSDT). The DSDT operates on the principle of generating minute deformations in a deformable material by the establishment of an electrostatic force from charges deposited by a cathode ray beam. The deformations in the material are translated into a visual image by projection through a Schlieren optical system. The DSDT has demonstrated feasibility to be a multipurpose display tube. It exhibits storage, controlled persistence, selectable erase, high resolution, high dynamic range, and display sizes from 6 to 60 inches from a single tube. Author (GRA)

N73-10259# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
HIGH POWER ARC LIGHT SOURCES Technical Report, Jun. 1968 - Jun. 1970
James F. Holt and Richard B. Rivir Nov. 1971 37 p refs
(AD-745565; AFAPL-TR-71-1) Avail: NTIS CSCL 13/1

Light or infrared sources in the 1 to 10 megawatt power range are usable for a variety of listed military and nonmilitary functions. The carbon arc source appears to be less limited physically, in terms of ultimate continuous power output, than the high pressure arc. The carbon arc is also more efficient. A review of the history and characteristics of various sources bears out these conclusions. Experiments were performed with 300-kilowatt and 700-ampere carbon arcs. Carbon powder was injected into the 700-ampere arc. A set of modifications on carbon arc technology are suggested in order to develop a 1 to 10 megawatt carbon arc requiring no mechanical anode rod feed. Alternating current magnets can be used to scan stabilizing fields and specially compounded anode materials contribute to quietness of the arc. Author (GRA)

N73-10260# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
POLYIMIDE FILMS FOR HYBRID CIRCUITS
Robert E. Hicks May 1972 43 p refs
(Contract N00017-72-C-4401)
(AD-745731; APL-TG-1195) Avail: NTIS CSCL 09/5

Polyimide films have a unique combination of properties that makes them ideally suited for hybrid and beam lead substrates. They maintain desirable chemical, electrical, and physical properties over a wide temperature range. Results of studies at APL show that these properties are advantageous in the fabrication of prototype hybrids, such as experimental amplifiers, inductors, and microwave circuits. Author (GRA)

N73-10261# Schjeldahl (G. T.) Co., Northfield, Minn. Advanced Programs Div.
FEASIBILITY STUDIES OF GRAY SCALE IMAGE STORAGE WITH ELECTROLUMINESCENT/PHOTOCONDUCTOR IMAGE CONVERSION PANELS Final Technical Report, 2 Mar. 1971 - 1 Mar. 1972
Donald E. Anderson and Richard L. Swisher 30 Mar. 1972 119 p
(Contract N00014-71-C-0276)
(AD-745758) Avail: NTIS CSCL 09/5

A study program is described in which the feasibility of achieving levels of gray scale image storage in EL/PC image storage panels is studied. Both thick film EL and thin film EL lamp arrays were prepared and studied. Effort was concentrated on two techniques: slow decaying thin film photoconductors and multifrequency electrical driving of fast response EL/PC panels. The combination of materials used were prepared in test sample form, electricaily and optically parameterized, and then computer simulations were performed to determine the range of parameters needed for a successful assembly. The computer models simulated the transient or steady state optical stimulation of EL/PC cells with simple sinusoidal power applied or more complicated waveforms. Author (GRA)

N73-10262# Schjeldahl (G. T.) Co., Northfield, Minn.
FEASIBILITY STUDIES OF MULTISPECTRAL MOSAIC IMAGE CONVERSION PANELS Final Report, 1 Feb. 1971 - 31 Jan. 1972
Donald E. Anderson and Richard L. Swisher 30 Mar. 1972 132 p
(Contract N00014-71-C-0188; NR Proj. 215-165)
(AD-745757) Avail: NTIS CSCL 09/5

A development program is described in which the feasibility of mosaic EL/PC image conversion panels sensitive to UV, near IR, X-rays, and visible light was studied. Thin Film photoconductors are electroded in a regular array with unit cells 0.020 inches on centers. These arrays are connected to opaque electrode arrays forming the back pads of an electroluminescent (EL) lamp array through the use of microglass spacer sheets. Both thick film EL and thin film (TFEL) lamp arrays were prepared and studied. The combinations of materials used were prepared in test sample form, electrically and optically parameterized, and then computer simulations were performed to determine the range of parameters needed for a successful assembly. The computer models simulate the transient or steady state optical stimulation of EL/PC cells with simple sinusoidal power applied or more complicated wave-forms. All computer programs used are documented. Author (GRA)

N73-10263# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
MUTUAL COUPLING EFFECTS IN SEMI-INFINITE LINEAR ARRAYS
Wasyl Wasylkiwskyj Jun. 1972 47 p refs
(AD-745799; P-802) Avail: NTIS CSCL 09/5

The scope of the paper is limited to a theoretical analysis of a linear semi-infinite array of uniformly spaced elements, but the analytical results thus obtained should prove of value in providing quantitative estimates of edge effects in large linear phased arrays. The analysis is sufficiently general to encompass the usual electrically small radiators commonly employed in phased arrays (viz., dipoles, slots, etc.). However, other than one example of an array of ideal elements (chosen more for its simplicity than realism) no specific numerical results have been obtained. The treatment is mathematical and the emphasis has been more on methods rather than concrete results. Author (GRA)

N73-10264# Harvard Univ., Cambridge, Mass. Cruft Lab.
MODIFIED DIPOLES. 1: THEORETICAL AND EXPERIMENTAL STUDY
Peter S. Kae Nov. 1971 79 p refs
(Contract F19628-68-C-0030; AF Proj. 5635)
(AD-745285; AFCRL-72-0112; SR-13-Vol-1) Avail: NTIS CSCL 09/5

The modified dipole has its origin in the consideration of the general properties of a satellite antenna which bears great resemblance to a dipole modified to incorporate at the center a conducting volume which is used to radiate electromagnetic waves and to house a power supply and radio frequency generators, etc. The object of the research is to pursue a theoretical and experimental exploration of the effects induced by the presence of the conducting volume on the antenna performance, i.e., input characteristics, current distribution along the surfaces of the entire radiating structure and radiation properties. In Volume 1 a mathematical model consisting of a perfectly conducting sphere from which project the ends of a thin biconical antenna is chosen to simulate the actual sphere-centered thin dipole. Author (GRA)

N73-10265# Army Foreign Science and Technology Center, Charlottesville, Va.
MICROMINIATURIZATION OF RADIO-ELECTRONIC EQUIPMENT, CHAPTERS 2, 4, AND 6
A. T. Belevsev 20 Jun. 1972 61 p refs Transl. into ENGLISH of chap. 2, 4, and 6 from the Russian publ. "Miniatyurizatsiya Radioelektronnoi Apparatury" 1965
(AD-745828; FSTC-HT-23-857-71) Avail: NTIS CSCL 09/3

A survey is presented of the current status and future prospects for microminiaturization, including its effect on the reliability of electronic equipment, printed circuits and their applications to microminiaturization, semiconductor devices, micromodular design and film and solid circuits. GRA

N73-10266# National Materials Advisory Board, Washington, D.C.
MATERIALS AND PROCESSES FOR ELECTRON DEVICES Final Report
May 1972 323 p
(Contract DA-49-083-OSA-3131)
(AD-745745; NMAB-289) Avail: NTIS CSCL 09/1

A survey has been made of materials and processes for solid state electronic devices. Problem areas have been identified; various solutions have been considered; recommendations have been made. The approach has been to search for areas of materials and processes innovation needed by the government based on the following criteria of effectiveness; adaptability; and service effectiveness through basic understanding, batch processing, and partitionability. Author (GRA)

N73-10267# Royal Inst. of Tech., Stockholm (Sweden).
ANALYSIS OF A SLOTTED CIRCULAR WAVEGUIDE
Lennart Marin Roy. Swedish Acad. of Eng. Sci. 1971 26 p refs
(PB-208160; APS-EL-28) Avail: NTIS $3.00; Acta Polytech. Scand. Publ. Office, Box 5073, S-102 42 Stockholm 5, Sweden: Sw. Kr. 10.00 CSCL 09A

The effect of a longitudinal slot in a circular waveguide is investigated. The study involves the formulation and solution of two boundary value problems. The first problem concerns a half infinite slot in the waveguide. The solution to this problem is used in solving the second one: a waveguide with a finite rectangular slot. Making use of leaky-wave modes and of the Wiener-Hopf and Galerkin procedures, the analysis leads to two systems of algebraic equations. The solution to these equations gives the tangential component of the electric field on the slot. The result is applied to the determination of the reflection coefficient and the far-field pattern for the incident wave being a TE sub 01-mode. GRA

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N73-10268# Australian Post Office Research Labs., Melbourne.
VARIATION OF BALANCED PAIR CABLE PARAMETERS WITH TEMPERATURE
V. K. Sargeant Feb. 1972 13 p refs
(Rept-6670) Avail: NTIS HC $3.00

A description is given of techniques which enable the variation of cable parameters with temperature to be determined. This information is required for the planning of wide band transmission systems. Parameters considered are characteristic impedance, cable attenuation and insertion loss. Author

N73-10269*# Lockheed Electronics Co., Houston, Tex.
DIFFERENTIAL PHASE SHIFT KEYED SIGNAL RESOLVER Patent Application
Phillip M. Hopkins and Wally M. Wallingford, inventors (to NASA) Filed 12 Oct. 1972 24 p
(Contract NAS9-10950)
(NASA-Case-MSC-14066-1; US-Patent-Appl-SN-297127) Avail: NTIS HC $3.25 CSCL 09E

A differential phase shift keyed signal receiver is described. The receiver resolves the differential phase shift in an incoming signal to determine the content and to overcome phase uncertainty without requiring a transmitted reference signal. The outputs of the transition logic and resolver logic change only when the bit synchronizer and/or shift register outputs change. Since the resolver logic has four output states, the output can be coded in a two-bit binary word. NASA

N73-10270# Atomic Weapons Research Establishment, Aldermaston (England).
RESPONSE OF ELECTRICALLY SHORT CABLES TO TRANSIENT ELECTROMAGNETIC FIELDS
R. Oats Aug. 1971 55 p refs
(AWRE-O-47/71) Avail: AEC Depository Libraries; UK £0.37

In an electromagnetic pulse environment, a major problem is the introduction of spurious signals into a system from external cabling. The amount of energy coupled into the system will depend upon cable parameters and other factors external to the cables. Whether or not the energy coupled into the system causes unacceptable perturbations or major system damage is dependent on the system at the cable terminations. Author

N73-10271# Illinois Univ., Urbana. Coordinated Science Lab.
FAST PERIODIC STEADY STATE ANALYSIS OF LARGE SIGNAL ELECTRONIC CIRCUITS
Francis Robert Colon May 1972 101 p refs
(Contract DAAB07-67-C-0199; Grant NSF GK-31633)
(AD-745639; R-564; UILU-ENG-72-2225) Avail: NTIS CSCL 09/5

A computer program has been developed to analyze the static, transient and steady state response of nonlinear circuits. The static or dc response of the circuit is obtained by using a nodal based Newton-Raphson iterative technique which has been modified to eliminate the usual instability and which gives fast reliable answers. The transient response is determined by using an A-stable variable step size integration formula applied directly to the nodal equations. With the mechanism for transient analysis established it is then possible to perform periodic analysis of nonlinear circuits through the use of a Newton iterative technique that will handle autonomous and non-autonomous systems and which has been found to be more reliable than harmonic balance techniques and which is much faster than simply integrating the equations until the transients become negligible. This technique then is especially valuable for analyzing high Q circuits and for design purposes where fast analysis is essential. Author (GRA)

N73-10272# Illinois Univ., Urbana. Coordinated Science Lab.
COMPARISON OF SOME DIRECT SEARCH OPTIMIZATION METHODS FOR THE DESIGN OF DISTRIBUTED LUMPED ACTIVE NETWORKS
Alvin Dale Olmstead Jun. 1972 49 p refs
(Contract DAAB07-67-C-0199; Grant NSF GK-31633)
(AD-745640; R-570; UILU-ENG-72-2231) Avail: NTIS CSCL 09/5

Computer-aided design is enjoying an ever increasing popularity among circuit designers for several reasons. The new generation of small, inexpensive, and efficient computers along with powerful analysis methods are among the major reasons. As electrical networks and systems are designed for ever higher frequencies where lumped elements are no longer well defined distributed models become necessary. The increasing complexity of networks, integrated circuits for example, and the usefulness of distributed elements such as transmission lines in impedance matching and the coupling of amplifiers has led to increased interest in numerical optimization techniques. Author (GRA)

N73-10273# Illinois Univ., Urbana. Coordinated Science Lab.
DELAY FREE REALIZATION OF ASYNCHRONOUS SEQUENTIAL SWITCHING CIRCUITS M.S. Thesis
Richard Louis Duncan Jul. 1972 50 p refs
(Contract DAAB07-67-C-0199)
(AD-746392; R-576; UILU-ENG-72-2237) Avail: NTIS CSCL 09/2

Asynchronous sequential circuits are sequential circuits which are free of a synchronizing clock signal. Asynchronous circuits allow the circuit designer to use the maximum available speed of his devices; however, the lack of synchronism may cause problems in the operation of some circuits. Unwanted output changes, or hazards, may occur in the output due to different parts of the circuit switching at different times. Hazards occurring in the feedback variables, or a race between two variables could cause the circuit to make a transition to a different state than the desired one. Author (GRA)

N73-10274# Illinois Univ., Urbana. Coordinated Science Lab.
COMPARISON OF QUASI-NEWTON METHODS FOR THE dc ANALYSIS OF ELECTRONIC CIRCUITS M.S. Thesis
William Hsia Kao Jul. 1972 82 p refs
(Contract DAAB07-67-C-0199; Grant NSF GK-31633)
(AD-746391; R-577; UILU-ENG-72-2238) Avail: NTIS CSCL 09/5

In the dc analysis of a circuit the capacitors and inductors in the circuit are replaced by open and short circuits, respectively, and the circuit is solved for constant source values (all time-varying signal sources are set to zero). In the analysis and design of electronic circuits the dc solution is called the quiescent, bias or operating point of the circuit and has many uses. For example, the operation of most electronic circuits is critically dependent on the quiescent point and it is important to know its value and its sensitivity with respect to parameter changes such as temperature, etc. In small signal analysis the quiescent point should be determined in order to calculate accurate small signal models. Finally, in transient analysis the initial states of the capacitors and inductors must be known, and this is accomplished by dc analysis. Author (GRA)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N73-10275*# Princeton Univ., N.J. Guggenheim Aerospace Propulsion Labs.
ENERGY DEPOSITION IN PARALLEL-PLATE PLASMA ACCELERATORS Ph.D. Thesis
Marco S. DiCapua Dec. 1971 178 p refs
(Grant NGL-31-001-005)
(NASA-CR-128408; Rept-1015) Avail: NTIS HC $11.00 CSCL 14B

To appraise the ratio of energy deposition into kinetic and thermal modes in plasma accelerators, a parallel-plate plasma accelerator has been operated in the quasi-steady mode with current pulses in the range of 10 to 100 kilo-amperes (kA), durations of the order of one millisecond, and argon mass flows up to 100 grams/sec. From photographic observations, spectroscopic measurements of velocity and electron density, and pressure measurements with a fast-rise piezoelectric transducer it is found that, for currents between 50 and 90 kA, the accelerated argon plasma is supersonic with ion velocities of 5 to 6 kilometers/sec. Author

N73-10276*# Virginia Univ., Charlottesville. Dept. of Aerospace Engineering and Engineering Physics.
DATA ACQUISITION AND REDUCTION FOR THE UNIVERSITY OF VIRGINIA SUPERCONDUCTING MAGNETIC SUSPENSION AND BALANCE FACILITY
I. D. Jacobson, J. L. Junkins, and J. R. Jancaitis [1970] 12 p refs
(Grants NGR-47-005-029; NGR-47-005; NGR-47-005-112)
(NASA-CR-1102186) Avail: NTIS HC $3.00 CSCL 14B

The problems associated with data acquisition and reduction in the U. Va. superconducting magnetic suspension and balance facility are similar to those in free-flight ranges (or tunnels). The model undergoes a quasi-six-degree-of-freedom motion which must be monitored both in position and angular orientation from which the aerodynamics must be inferred. The data acquisition problem is made more difficult because geometric constraints prevent direct visual access to the model in the Mach 3 wind tunnel. The methods, accuracies, and problems associated with the acquisition of data are discussed. Author

N73-10277# Tokyo Univ. (Japan). Inst. of Industrial Science.
[APPLIED PHYSICS AND ENGINEERING RESEARCH AND EDUCATION FACILITIES]
[1972] 43 p refs
Avail: NTIS HC $4.25

Brief descriptions of the facilities and educational and research programs are given for The Institute of Industrial Science of the University of Tokyo. The departments cover the following fields: applied physics and applied mechanics, mechanical engineering and naval architecture, electrical engineering and electronics, industrial chemistry and metallurgy, and building and civil engineering. N.E.N.

N73-10278# Aeronautical Research Inst. of Sweden, Stockholm.
A CROSS-FLEXURE STING AND MEASUREMENT OF DYNAMIC STABILITY DERIVATIVES OF TWO SCHEMATICAL MODELS AT M EQUALS 4 AND M EQUALS 7
Stig Lundgren 1972 33 p refs
(FFA-AU-637) Avail: NTIS HC $3.75

A cross-flexure sting for measurement of dynamic stability derivatives using free oscillation technique was built and shake-out tests on two schematic models were performed at Mach number 4 and 7. The models were slender bodies of revolutions with delta-wings. The wind tunnel tests were made at reduced frequencies between 0.006-0.017 using in part transient excitation and in part random excitation. The results from the two methods agreed, in those cases where they could be compared, within 15% in most cases but in one case not better than 25%. The accuracy of the transient data obtained in the tests was estimated to be better than 12% in most cases and 19% in some.
Author

N73-10279*# Computer Sciences Corp., Falls Church, Va. Geonautics Dept.
NASA DIRECTORY OF OBSERVATION STATION LOCATIONS, VOLUME 1
Nov. 1971 260 p refs 2 Vol.
(Contract NAS5-21322)
(NASA-CR-130071) Avail: NTIS HC $15.00 CSCL 14B

A directory of geodetic information for NASA tracking stations and observation stations in the NASA Geodetic Satellites Program is presented. A geodetic data sheet is provided for each station, giving the position of the station and describing briefly how it was established. Geodetic positions and geocentric coordinates of these stations are tabulated on local or major geodetic datums, and on selected world geodetic systems when available information permits. The principal tracking facilities used by NASA are described, including the NASA Network Facilities, the Deep Space Network, and several large radio telescopes. Positions of these facilities are tabulated on their local or national datums, the Mercury Datum 1960, the Modified Mercury Datum 1968, and the Apollo Reference System.
Author

N73-10280*# Computer Sciences Corp., Falls Church, Va. Geonautics Dept.
NASA DIRECTORY OF OBSERVATION STATION LOCATIONS, VOLUME 2
Nov. 1971 397 p refs 2 Vol.
(Contract NAS5-21322)
(NASA-CR-130072) Avail: NTIS HC $22.00 CSCL 14B

Geodetic information for NASA tracking stations and observation stations in the NASA Geodetic Satellites Program is documented. A Geodetic Data Sheet is provided for each station, giving the position of the station and describing briefly how it was established. Geodetic positions and geocentric coordinates of these stations are tabulated on local or major geodetic datums, and on selected world geodetic systems when available information permits. Observation stations in the NASA Geodetic Satellites Program and stations participating in the National Geodetic Satellite Program are identified. Station positions of these facilities are given on local or preferred major datums, and on the Modified Mercury Datum 1968.
Author

N73-10281# Pavement Safety Corp., Skokie, Ill.
RUNWAY FRICTION DATA FOR TEN CIVIL AIRPORTS AS MEASURED WITH A MU-METER AND DIAGONAL BRAKED VEHICLE Final Report, Nov. 1971 - Jul. 1972
Peter J. Nussbaum, William A. Hiering (Natl. Aviation Facilities Exptl. Center), and Charles R. Grisel (Natl. Aviation Facilities Exptl. Center) Jul. 1972 297 p refs Prepared in cooperation with Natl. Aviation Facilities Exptl. Center
(Contract DOT-FA72WA-2744; Proj.183-731-027/03x)
(PSC-107; FAA-RD-72-61) Avail: NTIS HC $17.00

Runway friction measurements were made on ten civil airports representative of large and medium hub airports. Wet and dry surface data were obtained with a Mu-Meter and FAA Diagonal Braked Vehicle. Pavements were wetted with sprinkler trucks. Water depth and friction data were time correlated. DBV data were normalized to 60 MPH and corrected for ambient temperature per NASA methods. Specialized supplementary equipment used and techniques and procedures developed to conduct the tests are described. Raw and processed data for each airport are tabulated in separate appendixes. Included are runway and airport traffic statistics and photographs of the pavements tested. A summary table of friction data is shown to facilitate review and analysis of information.
Author

N73-10282*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A PREDICTION MODEL FOR LIFT-FAN SIMULATOR PERFORMANCE M.S. Thesis - Cleveland State Univ.
Joseph Alfred Yuska Aug. 1972 71 p refs
(NASA-TM-X-68788) Avail: NTIS HC $5.75 CSCL 14B

The performance characteristics of a model VTOL lift-fan simulator installed in a two-dimensional wing are presented. The lift-fan simulator consisted of a 15-inch diameter fan driven by a turbine contained in the fan hub. The performance of the lift-fan simulator was measured in two ways: (1) the calculated momentum thrust of the fan and turbine (total thrust loading), and (2) the axial-force measured on a load cell force balance (axial-force loading). Tests were conducted over a wide range of crossflow velocities, corrected tip speeds, and wing angle of attack. A prediction modeling technique was developed to help in analyzing the performance characteristics of lift-fan simulators. A multiple linear regression analysis technique is presented which calculates prediction model equations for the dependent variables.
Author

N73-10283*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A GENERALIZED THEORY FOR THE DESIGN OF CONTRACTION CONES AND OTHER LOW SPEED DUCTS
Raymond L. Barger and John T. Bowen Washington Nov. 1972 44 p refs
(NASA-TN-D-6962; L-8448) Avail: NTIS HC $3.00 CSCL 14B

A generalization of the Tsien method of contraction cone design is described. The design velocity distribution is expressed in such a form that the required high order derivatives can be obtained by recursion rather than by numerical or analytic differentiation. The method is applicable to the design of diffusers and converging-diverging ducts as well as contraction cones. The computer program is described and a FORTRAN listing of the program is provided.
Author

N73-10284*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MASKMAKING FACILITIES AT THE MARSHALL SPACE FLIGHT CENTER
Donald E. Routh 6 Nov. 1972 13 p ref
(NASA-TM-X-64703) Avail: NTIS HC $3.00 CSCL 14B

Research and development maskmaking facilities at the Marshall Space Flight Center are described. Information is provided on the level of cleanliness and the environmental control within the various work areas. The available equipment and its function in the maskmaking process are detailed.
Author

N73-10285# Institut Franco-Allemand de Recherches, St. Louis (France).
EXPLORATORY STUDY OF THE CALIBER EFFECT IN IMPACT PHYSICS [ETUDE EXPLORATOIRE DE L'EFFET D'ECHELLE EN PHYSIQUE DES IMPACTS]
G. Herbette 3 Dec. 1970 37 p refs In FRENCH
(ISL-24/70) Avail: NTIS HC $4/00

Results obtained during light gas gun launches (1.6 and 5 mm projectiles) and plasma lithium accelerator launches (50 and 150 mm projectiles) show a scale effect using glass projectiles on aluminum targets. On these targets the relative damage was increased by a factor of two in depth and three or five in volume when the projectile diameter was varied from 0.05 to 5 mm.
Author (ESRO)

N73-10286# Institut fuer Chemie der Treibstoffe, Berghausen (West Germany).
SHALLOW WATER TUNNEL FOR SIMULATION OF GAS FLOWS IN VELOCITY RANGE OF 0.6>M>3.5 [SEICHTWASSERKANAL ZUR SIMULIERUNG VON GASSTROEMUNGEN IM GESCHWINDIGKEITSBEREICH 0.6>M>3.5]
W. Steinhilper 31 Dec. 1971 29 p refs In GERMAN
(ICT-4/71) Avail: NTIS HC $3.50

The analogy between a plane isentropic gas flow and a shallow water flow is described and the design of a hydraulic analogy facility discussed. The problems presented by analogy tests are reviewed. The concept of flowing water and immobile model, rather than still water and moving model is preferred

because of simplification of the construction and easier and faster evaluation of flow patterns. An equality can be reached between Mach number and Froude number, but the equality of Reynolds numbers of the flows can only be realized by approximation. The application of the channel is limited to qualitative investigation. Author (ESRO)

N73-10287# Dansk Industri Syndikat A/S, Herlev.
DATA TRANSMISSION AND PROCESSING SYSTEM FOR THE AUTOMATIC BALANCING OF A THREE-AXIS SATELLITE MOTION SIMULATOR
J. C. Hoelgaard Paris ESRO Jun. 1972 38 p refs
(Contract ESTEC-1120/70)
(ESRO-CR-54) Avail: NTIS HC $4.00

The method of balancing an air bearing-supported table, the purpose of which is to simulate the dynamic, triaxial motion of a satellite in space, is reviewed in some detail. The motion of the unbalanced table is registered by optical means and the associated information is fed to a computer. The computer then calculates the three components of the unbalance vector and sends the calculated data to the system described. One part of this system is situated on the ground and converts the parallel data from the computer into serial form and then provides for the wireless transmission of these serial data to the simulator table, where the other part of the system is installed. The second part of the system controls the position of movable weights that are situated in the table. By positioning the weights according to the instructions in the received data, the center of gravity of the simulator table is shifted so that the required balance is obtained. Author (ESRO)

N73-10288# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Aerodynamik.
DESCRIPTION OF A MODEL WIND TUNNEL FOR THE LARGE SUBSONIC WIND TUNNEL (GUK) PROJECT [BESCHREIBUNG EINES MODELLWINDKANALS FUER DAS PROJEKT "GROSSER UNTERSCHALL-KANAL' (GUK)]
Fred Thomas and Rudolf Mueller Apr. 1972 23 p refs In GERMAN; ENGLISH summary
(DLR-MITT-72-21) Avail: NTIS HC $3.25; DFVLR, Porz 8 DM

A model subsonic wind tunnel with scale 1:7.3 is proposed for the optimal design of a large wind tunnel, and its possibilities for later use are shown. A modular design is recommended, which permits simple conversion by exchanging segments. This is also important for later application. A conversion foreseen could be in measurement of laminar profiles, as it is possible to reach a high contraction ratio and thus little turbulence. Cost estimates for the scale model are given. Author (ESRO)

N73-10289# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
MEASUREMENTS OF HEAT TRANSFER RATES BEHIND AXIALLY SYMMETRIC BACKWARD FACING STEPS IN THE SHOCK TUBE, PART 1 Final Scientific Report
Michael Green and Josef Rom Dec. 1970 36 p refs
(Contract F61052-70-C-0005; AF Proj. 7063)
(AD-735745; TAE-115; ARL-71-0305-Pt-1) Avail: NTIS CSCL 20/4

Heat transfer rates were measured in the separated flow region behind a series of eight axisymmetric backward facing step models. Four step heights were used with two forebody lengths for each height. The work was performed in the shock tube at flow Mach numbers between 1.4 to 2.5. Movement of the reattachment zone with flow conditions and model dimensions is examined, and the results are investigated for a referenced inverse relation between the value of the peak heat transfer rate and the distance between the separation point to the position of the maximum heat transfer rate. GRA

N73-10290# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
MEASUREMENTS OF HEAT TRANSFER RATES BEHIND AXIALLY SYMMETRIC BACKWARD FACING STEPS IN THE SHOCK TUBE AND THE SHOCK TUNNEL, PART 3 Final Scientific Report
Michael Green and Josef Rom May 1971 77 p refs
(Contract F61052-70-C-0005; AF Proj. 7063)
(AD-735744; TAE-127-Pt-3; ARL-71-0268-Pt-3) Avail: NTIS CSCL 14/2

Measurements of heat transfer rates on cone-cylinder models and in the separated regions behind an axially symmetric backward facing step are reported. The measurements were obtained in the shock tube at flow Mach numbers between 1.4 to 2.5. The heat transfer in the separated region is studied for variation of the flow Mach number from the supersonic values obtained in the shock tube to the hypersonic value obtained in the shock tunnel. The position of the maximum heating rate is noted for step height and forebody length. It is found that the point of maximum heating moves downstream with increasing step height while increasing forebody length causes an upstream movement of this point. GRA

N73-10291# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
CONDITION SURVEY, CAMPBELL ARMY AIRFIELD, FORT CAMPBELL, KENTUCKY
P. J. Vedros and S. J. Alford Jun. 1972 23 p
(AD-743462; AEWES-Misc-Paper-S-72-19) Avail: NTIS CSCL 01/5

The purpose of the report is to present the results of an investigation performed at Campbell Army Airfield (CAAF) in April 1971. The inspection was limited to visual observations, and no tests were conducted on the existing runways and taxiways. Author (GRA)

N73-10292# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
CONDITION SURVEY, FORT POLK ARMY AIRFIELD, FORT POLK, LOUISIANA
P. J. Vedros Jun. 1972 19 p ref
(AD-743858; AEWES-Misc-Paper-S-72-24) Avail: NTIS CSCL 01/5

The purpose of this report is to present the results of an investigation at Fort Polk Army Airfield (FPAA) in March 1971. The inspection was limited to visual observations and no tests were conducted on the existing runways and taxiways at that time. Author (GRA)

N73-10293# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
CONDITION SURVEY, BUTTS ARMY AIRFIELD FORT CARSON, COLORADO
P. J. Vedros and R. D. Jackson Jun. 1972 16 p ref
(AD-743859; AEWES-Misc-Paper-S-72-26) Avail: NTIS CSCL 01/5

The purpose of this report is to present the results of an inspection performed at Butts Army Airfield (BAAF) in September 1971. The inspection was limited to visual observations, and no tests were conducted on any of the pavement facilities. Author (GRA)

N73-10294# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
CONDITION SURVEY, FORNEY ARMY AIRFIELD, FORT LEONARD WOOD, MISSOURI
P. J. Vedros and R. D. Jackson Jun. 1972 14 p ref
(AD-743856; AEWES-Misc-Paper-S-72-22) Avail: NTIS CSCL 13/2

The purpose of the report is to present the results of an inspection performed at Forney Army Airfield (FAAF) in April 1971. The inspection was limited to visual observations, and no tests were conducted on any of the pavement facilities. A layout of the airfield is shown. Author (GRA)

N73-10295# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
CONDITION SURVEY, REDSTONE ARMY AIRFIELD, HUNTSVILLE, ALABAMA
P. J. Vedros and S. J. Alford Jun. 1972 20 p ref
(AD-743857; AEWES-Misc-Paper-S-72-23) Avail: NTIS CSCL 13/2

The purpose of this report is to present the results of an investigation performed at Redstone Army Airfield (RAAF) in April 1971. The inspection was limited to visual observations,

and no tests were conducted on the existing runway and taxiways. A layout of the airfield is shown. GRA

N73-10296# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
CONDITION SURVEY, DAVISON ARMY AIRFIELD, FORT BELVOIR, VIRGINIA
P. J. Vedros and R. D. Jackson Jun. 1972 17 p
(AD-743463; AEWES-Misc-Paper-S-72-20) Avail: NTIS CSCL 01/5

The purpose of the report is to present the results of an inspection performed at Davison Army Airfield in August 1971. The inspection was limited to visual observations, and no tests were conducted on the existing runways and taxiways.
Author (GRA)

N73-10297# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
ENGINEER DESIGN TESTS OF DUST CONTROL MATERIALS AND EMPLACEMENT EQUIPMENT Final Report
Moody M. Culpepper and Warren A. Wilvert Jun. 1972 49 p ref
(DA Proj. 1G6-64717-PH-01)
(AD-745086; AEWES-MISC-PAPER-S-72-14) Avail: NTIS CSCL 01/5

The report describes and presents the results of engineer design tests (EDT) of two dust-control materials, a polyvinyl acetate (PVA) water emulsion and a cationic asphalt-neoprene emulsion (CANE), and two distributors, one pneumatic and one mechanical, that were used to apply the PVA and CANE. Both distributors were used to apply the PVA and CANE with no reinforcing, with fiberglass scrim reinforcing, and with prechopped fiberglass reinforcing to sand and clay soils in an intermediate climate. The materials were allowed to cure for 4 hr after placement and were then subjected to the simulated airblast of a CH-47 helicopter and a C-130 aircraft and to traffic by 1/4-and 2-1/2-ton vehicles. Only minor deficiencies in the PVA and CANE, i.e., instability in storage, excessive runoff, and tackiness after 4 hr curing time, were observed during testing. Author (GRA)

N73-10298# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.
WET STEAM TUNNEL FACILITY DESIGN AND PROGRAM OF INVESTIGATIONS
J. Krzyzanowski Jun. 1972 21 p refs
(Grant NSF GK-730)
(PB-210654; UMICH-03371-18-T) Avail: NTIS HC$3.00 CSCL 14B

A low-pressure wet-steam tunnel to be constructed and used in the Cavitation and Multiphase Flow Laboratory is described, and the research program for its future use is discussed.
Author (GRA)

N73-10299# Naval Postgraduate School, Monterey, Calif.
BEAM CURRENT MONITORING AND RADIACHROMIC FILM DOSIMETRY AT THE NAVAL POSTGRADUATE SCHOOL LINAC M.S. Thesis
Frederick Colbert Gray Jun. 1972 65 p refs
(AD-745841) Avail: NTIS CSCL 20/7

The beam current monitoring system at the NPS electron Linac was studied to determine its performance under varying conditions of machine operation. The efficiency of the secondary emission monitors (SEM Efficiency), defined as the ratio of SEM current of Faraday cup current, was found to increase with increasing beam energy, increase with the introduction of targets into the beam, and vary erratically with SEM foil surface conditions. No dependence on beam current was observed. The spatial variation of electron fluence (time-integrated flux) was investigated using RACM 203 radiachromic film developed by the EC-G Corporation. The optical density of this film was found to vary linearly with absorbed dose over a range of 5 to 40 megarads.
Author (GRA)

N73-10300# General Motors Corp., Goleta, Calif. Delco Electronics Div.
REMOTE AUTOMATIC MULTIPURPOSE STATION
B. M. Buck and W. P. Brown Jul. 1972 7 p
(Contract N00014-71-C-0357; ARPA Order 1783; NR Proj. 307-304)
(AD-746496; TR-4) Avail: NTIS CSCL 09/6

The report describes the second Remote Automatic Multipurpose Station (RAMS) which was established to provide remote sensing of oceanographic and meteorological data in the Arctic regions.
Author (GRA)

N73-10018* United Aircraft Corp., East Hartford, Conn. Research Labs.
ANALYTICAL AND EXPERIMENTAL EVALUATION OF PROPOSED RIDE COMFORT CRITERIA
E. Wayne Vinje *In* NASA. Langley Res. Center Symp. on Vehicle Ride Quality Oct. 1972 p 115-141 (For availability see N73-10012 01-02)
CSCL 01A

N73-10022* Boeing Co., Seattle, Wash. Naval Systems Div.
MARINE VEHICLE RIDE QUALITY
R. J. Gornstein, W. M. Shultz, and L. D. Stair *In* NASA. Langley Res. Center Symp. on Vehicle Ride Quality Oct. 1972 p 197-209 refs (For availability see N73-10012 01-02)
CSCL 13F

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N73-10301 Engineering Sciences Data Unit, London (England).
PRANDTL NUMBER OF WATER SUBSTANCE: WATER AND STEAM, LIQUID AND GASEOUS HEAVY WATER, AND SEA WATER
Sep. 1968 21 p refs Sponsored by the Inst. of Mech. Engr. and the Inst. of Chem. Engr.
(ESDU-68011) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

Values of the Prandtl number for ordinary and heavy water phases are presented in tables and charts as functions of temperature and pressure. The data given include the values for: (1) water, steam, and supercritical steam; (2) liquid and gaseous D2O; and (3) sea water with a salinity of 33 g/kg.
D.L.G.

N73-10302 Engineering Sciences Data Unit, London (England).
DENSITY OF WATER SUBSTANCE: ICE, WATER AND STEAM, LIQUID AND GASEOUS HEAVY WATER, AND SEA WATER
Nov. 1971 32 p refs Sponsored by Inst. of Mech. Engr. and Inst. of Chem. Engr.
(ESDU-68010-Amend-A) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

Tables of data containing the densities of water substances in the form of ice, water and steam, liquid and gaseous heavy water, and sea water are presented. The values are for the pure single component of water. Other limitations which affect the application of the data to water containing impurities are analyzed.
Author

N73-10303 Engineering Sciences Data Unit, London (England).
DYNAMIC VISCOSITY OF WATER SUBSTANCE: WATER AND STEAM, LIQUID AND GASEOUS HEAVY WATER, AND SEA WATER
Apr. 1968 45 p refs Sponsored by Inst. of Mech. Engr. and Inst. of Chem. Engr.
(ESDU-68009) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

Dynamic viscosity data are presented in tables which include: (1) water, steam, and supercritical steam; (2) liquid, saturated, and gaseous D2O; and (3) sea water of salinity 33 g/kg. In addition, a series of charts is provided in which the

viscosity values of steam and water are plotted as functions of temperature and pressure. D.L.G.

N73-10304 Engineering Sciences Data Unit, London (England).
USER GUIDE TO THE FLUID MECHANICS, EXTERNAL FLOW SUB-SERIES
N. Thompson Jul. 1971 7 p refs
(ESDU-FME-1) Copyright. Avail: On subsription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

The methodology is described for effective utilization of a series of fluid mechanics data pertaining to external flow. The methods given enable the reference data user to predict the forces exerted on bodies and structures of the non-streamline type. The treatment is illustrated in examples involving application to real bodies and to bodies in ducts or pipes. D.L.G.

N73-10305 Engineering Sciences Data Unit, London (England).
APPROXIMATE DATA ON THE VISCOSITY OF SOME COMMON LIQUIDS
Jul. 1966 29 p refs Sponsored by the Inst. of Mech. Engr. and the Inst. of Chem. Engr.
(ESDU-66024) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

The variation of viscosity with temperature, at atmospheric or saturation pressure is given for a wide range of liquids. It is intended as a convenient collection of data for those who do not require a high degree of accuracy. The data are presented graphically and an index to the liquids is given. Author

N73-10306 Engineering Sciences Data Unit, London (England).
VISCOSITY OF WATER
Dec. 1965 9 p refs Sponsored by Inst. of Mech. Engr.
(ESDU-65009) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

Data on the viscosity of water are presented. Distilled water at 20 C and atmospheric pressure is recommended at the reference standard for the calibration of viscometers. Variations in the viscosity of sea water compared with distilled water are examined. Reference values for the dynamic viscosity and the kinematic viscosity are developed. Author

N73-10307# Aeronautical Research Labs., Melbourne (Australia).
SOME MEASUREMENTS OF THE INTERMITTENCY FUNCTION IN AN OPEN CHANNEL FLOW IN THE REGION IMMEDIATELY DOWNSTREAM OF A NATURAL TRANSITION
Douglas Sherman Feb. 1972 28 p refs
(ARL/SM-Note-374) Avail: NTIS HC $3.50

The mean durations of turbulent bursts and of non-turbulent periods were measured at several distances from the wall in a fairly low Reynolds number turbulent boundary layer at the bottom of an open channel. The profile of intermittency factor is somewhat different to that obtained in previous measurements at higher Reynolds numbers. The differences indicate that at low Reynolds numbers the mean position of the interface between turbulent and non-turbulent flow is further out in the boundary layer. The mean durations of turbulent and non-turbulent periods appear to provide a better test of the normality (or otherwise) of the probability distribution of the position of the interface than does the profile of intermittency factor, and the profile of turbulent intermittency frequency provides a much more sensitive test of the development of the wake portion of the turbulent boundary layer, than does the profile of intermittency factor. The full development of this wake region does not occur until a considerable distance downstream of the point which is normally considered to be the end of transition. Theoretical formulas are presented for the variation across a section, of turbulent intermittency frequency and the mean durations of turbulent bursts and non-turbulent periods. Author

N73-10308# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
TRANSFER OF MOMENTUM AND HEAT IN TURBULENT SEPARATED FLOWS
D. B. Spalding Mar. 1972 27 p Presented at the 4th All-Union Conf. on Heat and Mass Transfer, Minsk, May 1972
(EF/TN/A/49) Avail: NTIS HC $3.50

Turbulent separated-flow phenomena are characterized experimentally by special heat transfer correlations (Stanton number varies as the Reynolds number to the -0.35 power), physically by the importance of turbulence diffusion, and mathematically by the ellipticity of the governing equations. A review is made of the theoretical methods which are now available for predicting turbulent separated flows. Examples are presented of computations of both two- and three-dimensional phenomena, and some of them are compared with experimental data. Author

N73-10309*# Stanford Univ., Calif. Dept. of Mechanical Engineering.
COMPUTATION OF TURBULENT FLOWS–STATE-OF-THE-ART, 1970
W. C. Reynolds Feb. 1972 97 p refs
(Grants NGR-05-020-420; NSF GK-10034)
(NASA-CR-128372; SU-MD-27) Avail: NTIS HC $7.00 CSCL 12D

The state-of-the-art of turbulent flow computation is surveyed. The formulations were generalized to increase the range of their applicability, and the excitement of current debate on equation models was brought into the review. Some new ideas on the modeling of the pressure-strain term in the Reynolds stress equations are also suggested. Author

N73-10310*# Translation Consultants, Ltd., Arlington, Va.
STATISTICAL THEORY OF INHOMOGENEOUS TURBULENCE. PART 1
J. Rotta Washington NASA Oct. 1972 28 p refs Transl. into ENGLISH from Z. Phys. (West Germany), v. 129, 1951 p 457-572
(Contract NASw-2038)
(NASA-TT-F-14560) Avail: NTIS HC $3.50 CSCL 20D

Differential equations for the statistical correlation between two components of velocity variations are derived from the Navier-Stokes equations of motion and the effect of the terms appearing in the equations discussed. Of special significance here are the correlations between pressure variations and the variations of the velocity derivations, the purpose of which is to distribute the variations of velocity uniformly in all directions. A calculated example of a shearing parallel flow demonstrates the interaction of individual effects and makes comparisons with experimental results possible. Author

N73-10311*# Lockheed Electronics Co., Houston, Tex.
SPIN WAVES IN FLUIDS
Ernest L. Kistler Feb. 1972 65 p refs
(Contract NAS9-12200)
(NASA-CR-128532) Avail: NTIS HC $5.25 CSCL 20D

A working report is presented in order to document early results of research on the stability of laminar boundary layers. The report shows that constitutive equations for a structured continua may be derived by the technique of reinterpreting velocity in the conventional stress to rate-of-strain relationship so as to account for effects of particle rotation. It is demonstrated that accounting for particle structure even at a molecular level makes the fluid viscoelastic with the ability to propagate vector waves. It is shown that particle structure modifies the basic stability equation for the system, which in turn would alter values for critical Reynolds number. Author

N73-10312*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECTS OF CIRCULAR GEOMETRY IN SIMULATION OF CONVECTION IN ROTATING SPACECRAFT TANKS
E. Dale Martin, Barrett S. Baldwin, and Margaret Covert Washington Oct. 1972 23 p refs
(NASA-TR-R-392; A-4513) Avail: NTIS HC $3.00 CSCL 20D

For computational simulation of the convection and mixing of stratified fluid in a rotating tank (such as used in Apollo flights) with time-dependent rotation, the Navier-Stokes convection problem was formulated for a circular tank configuration. The final equations results from a general approximate theory for combined forced and contained natural convection in a time-dependent rotating system. The equations are cast in terms of vorticity and stream function in a form convenient for computation,

with a transformed coordinate system, and appropriate boundary conditions are derived. Accurate representations for the cryogenic supercritical oxygen thermodynamic properties are used in the computations, and an efficient numerical finite difference scheme and computational method are employed. Author

N73-10313*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A METHOD FOR CALCULATING LAMINAR VISCOUS, COMPRESSIBLE FLOWS WITH SMALL PRESSURE GRADIENTS

E. Dale Martin Washington Oct. 1972 19 p refs

(NASA-TN-D-6998; A-4514) Avail: NTIS HC $3.00 CSCL 20D

A method is presented for calculating laminar viscous, compressible flows in which pressure gradients are assumed to be negligible in energy conservation and in developing property relations, but not in momentum conservation. The equations are developed from Navier-Stokes equations in a noninertial reference frame. The method is an extension of an approximate method developed for calculating combined forced and contained natural convection in a rotating tank. The restriction to small density and temperature variations in the previous method is removed. For illustration, a two-dimensional simulation of the rotating tank problem is formulated, and the numerical computation procedure to be used is indicated. Author

N73-10314*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

SHOCK WAVES AND DRAG IN THE NUMERICAL CALCULATION OF ISENTROPIC TRANSONIC FLOW

Joseph L. Steger and Barrett S. Baldwin Washington Oct. 1972 46 p refs

(NASA-TN-D-6997; A-4519) Avail: NTIS HC $3.00 CSCL 20D

Properties of the shock relations for steady, irrotational, transonic flow are discussed and compared for the full and approximate governing potential in common use. Results from numerical experiments are presented to show that the use of proper finite difference schemes provide realistic solutions and do not introduce spurious shock waves. Analysis also shows that realistic drags can be computed from shock waves that occur in isentropic flow. In analogy to the Oswatitsch drag equation, which relates the drag to entropy production in shock waves, a formula is derived for isentropic flow that relates drag to the momentum gain through an isentropic shock. A more accurate formula for drag, based on entropy production, is also derived, and examples of wave drag evaluation based on these formulas are given and comparisons are made with experimental results. Author

N73-10315*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

CHARTS FOR PREDICTING TURBULENT SKIN FRICTION FROM THE VAN DRIEST METHOD (2)

Edward J. Hopkins Washington Oct. 1972 48 p refs

(NASA-TN-D-6945; A-4488) Avail: NTIS HC $3.00 CSCL 20D

Charts are presented for rapidly estimating local or average turbulent skin friction on flat plates from Reynolds numbers, based on either length or momentum thickness. These charts facilitate the conversion from one Reynolds number to the other. Ranges of variables covered are: Mach number, 0 to 10; length Reynolds number, 10 to the 5th to 10 to the 9th power; and wall-to-adiabatic-wall temperature ratio, 0.2 to 1.0. Author

N73-10316*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

MEASURED AND CALCULATED MEAN FLOW PROPERTIES OF A TWO-DIMENSIONAL, HYPERSONIC, TURBULENT WAKE

Richard D. Wagner Washington Nov. 1972 34 p refs

(NASA-TN-D-6927; L-8158) Avail: NTIS HC $3.00 CSCL 20D

The hypersonic turbulent wake produced by a wedge was studied experimentally and its properties were compared with predictions obtained from a numerical computation procedure. In the computation procedure several models for the eddy viscosity formulation of the turbulent transport were examined. Conventional-defect models and a modified mixing-length model were found to yield good predictions of the experimental data. The classical mixing-length model gave unrealistic results. The experimental data displayed similarity when velocity and temperature defects were scaled by the maximum defects and the transverse coordinate was scaled by the velocity-defect half-width. Author

N73-10317*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.

HYPERSONIC SHOCK WAVE INTERACTION AND IMPINGEMENT

W. C. Kessler, J. F. Reilly, and E. Sampatacos (Martin Marietta Corp., Denver, Colo.) 1 Oct. 1971 37 p refs Supersedes MDC-E0427

(Contract NAS9-11082)

(NASA-CR-128587; MDC-E0476; MDC-E0427) Avail: NTIS HC $4.00 CSCL 20D

An experimental investigation was conducted on space shuttle type, body-wing configurations. The purpose of the investigation was to determine the effects of body and wing geometry on the hypersonic shock structure about these vehicles and on the resulting surface impingement of interior flow field shock and expansion waves. Schlieren photographs and thermographic phosphor paint data were obtained on three body cross sections with three wing planforms at 40, 50 and 60 degree angles of attack. Specific configuration data were obtained at 0 and 30 degree angles of attack to develop trends. These data were obtained at a nominal Mach number of 13.5 and a freestream unit Reynolds number of 0.7 million per foot. For comparison with these straight wing configurations, data were also obtained on a model of a point design, high cross-range, delta wing orbiter at 40, 50 and 60 degree angles of attack. As expected, the data on this delta wing orbiter indicated that the shock intersection/impingement phenomena associated with straight wing vehicles are considerably more complex than, and result in both windward and leeward surface heating regions not present on, the delta configuration. Author

N73-10318*# Texas Univ., Austin. Dept. of Aerospace Engineering and Engineering Mechanics.

HYPERSONIC SHOCK-INTERACTION PHENOMENA APPLICABLE TO SPACE SHUTTLE CONFIGURATIONS

John J. Bertin and Bruce W. Graumann Aug. 1972 97 p refs

(Contract NAS9-11082)

(NASA-CR-128586; ER-72003) Avail: NTIS HC $7.00 CSCL 20D

The convective heat transfer distribution for space shuttle configurations is discussed. The viscous/inviscid interactions associated with the complex three dimensional flow fields are examined. Two basic conditions are considered as follows: (1) models consisting of basic elemental combinations and (2) models of specific flight vehicles. The test facilities and test programs used to obtain data on the fuselage flow field and the wing flow field are described. Author

N73-10319# California Univ., Santa Barbara. Dept. of Mechanical Engineering.

CAVITY RADIUS VS. ENERGY DISSIPATION RATE IN LIQUID FILLED, PROCESSING, SPHERICAL CAVITIES

James P. Vanyo 17 Jul. 1972 18 p refs Backup document for AIAA Synoptic scheduled for publication in the AIAA Journal, March 1973

Avail: NTIS HC $3.00

Experimental results and an idealized model are presented that yield energy dissipation rates (P) as a function of radius (R) for liquid-filled, precessing, spherical cavities. Experiments were conducted using cavities 11, 16.5, and 22 centimeters in diameter and filled first with water to give turbulent flow conditions, and next with a silicone liquid to give laminar flow conditions. Experimental data yields P approaches infinity R sup 4.10 to R sup 4.55 for turbulent flow and P approaches R sup infinity R sup 5.25 to R sup 5.45 for laminar flow. The idealized model treats the net motion of the liquid as a rigid sphere separated from the cavity wall by an Ekman type boundary layer. The relationship P approaches infinity R sup k, where $k > 3$, leads to a conclusion that P is minimized, for a given mass of

liquid, by using many small cavities rather than one, or a few, large cavities. Author

N73-10320*# Techtran Corp., Glen Burnie, Md.
BOUNDARY LAYER CONTROL OF HYPERSONIC AIR INLETS
D. A. Ogorodnikov, V. T. Grin, and N. N. Zakharov Washington NASA Oct. 1972 15 p Transl. into ENGLISH "Upr. Pogranichnym Sloyem v Giperzvukovykh Vozdukhozabornikakh" USSR, Jun. 1972 14 p Presented at the 1st Intern. Symp. on Air Breathing Engines, Marseille, Jun. 1972
(Contract NASw-2037)
(NASA-TT-F-13927) Avail: NTIS HC $3.00 CSCL 20D

Boundary layer control with respect to methods for hypersonic conditions using tangential injection of gas is discussed. The analysis accounts for the effects of heat dissipation caused by separation of the boundary layer and the influence of the friction coefficient. The conditions of a flow separation developing during the interaction of a shock wave with a turbulent boundary layer are examined. Mathematical models and graphs are included to clarify the theoretical considerations. Author

N73-10321*# Cornell Univ., Ithaca, N.Y.
FINITE-AMPLITUDE PRESSURE WAVES IN THE RADIAL MODE OF A CYLINDER
Isoroku Kubo and Franklin K. Moore Washington NASA Nov. 1972 36 p refs
(Grant NGL-33-010-042)
(NASA-CR-2138) Avail: NTIS HC $3.00 CSCL 20D

A numerical study of finite-strength, isentropic pressure waves transverse to the axis of a circular cylinder was made for the radial resonant mode. The waves occur in a gas otherwise at rest, filling the cylinder. A method of characteristics was used for the numerical solution. For small but finite amplitudes, calculations indicate the existence of waves of permanent potential form. For larger amplitudes, a shock is indicated to occur. The critical value of the initial amplitude parameter in the power series is found to be 0.06 to 0.08, under various types of initial conditions. Author

N73-10322*# United Aircraft Corp., East Hartford, Conn. Research Labs.
ASSESSMENT OF A TRANSITIONAL BOUNDARY LAYER THEORY AT LOW HYPERSONIC MACH NUMBERS
S. J. Shamroth and H. McDonald Washington NASA Nov. 1972 69 p refs
(Contract NAS1-10865)
(NASA-CR-2131) Avail: NTIS HC $3.00 CSCL 20D

An investigation was carried out to assess the accuracy of a transitional boundary layer theory in the low hypersonic Mach number regime. The theory is based upon the simultaneous numerical solution of the boundary layer partial differential equations for the mean motion and an integral form of the turbulence kinetic energy equation which controls the magnitude and development of the Reynolds stress. Comparisions with experimental data show the theory is capable of accurately predicting heat transfer and velocity profiles through the transitional regime and correctly predicts the effects of Mach number and wall cooling on transition Reynolds number. The procedure shows promise of predicting the initiation of transition for given free stream disturbance levels. The effects on transition predictions of the pressure dilitation term and of direct absorption of acoustic energy by the boundary layer were evaluated. Author

N73-10323# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
FILM COOLING OF HYPERSONIC INLETS
O. C. Ledford and J. L. Stollery Jul. 1972 27 p refs Presented at the 1st Intern. Symp. on Air Breathing Eng., Marseille, 19-23 Jun. 1972
(Contract MIN-DEF-AT/2037/056)
(IC-Aero-72-15) Avail: NTIS

Experiments are described in which the effectiveness of film cooling from a single slot on a flat plate was found by measuring the surface heat transfer rate distribution at Mach numbers between 7 and 10. The intake of an air breathing engine at hypersonic speeds was subjected to such high thermal loads that active cooling was necessary. The whole spectrum of laminar, transitional, and turbulent flow was examined using air, helium, and Freon 12 as coolants. Recent work on film cooled flat plates subjected to shock wave interaction with a turbulent boundary layer is described. It was found that coolant injection made little reduction to the heat transfer in the shock region. Author (ESRO)

N73-10324# Institut Franco-Allemand de Recherches, St. Louis (France).
ABEL TRANSFORMATION. APPLICATIONS TO WAKE DENSITY MEASUREMENT [LA TRANSFORMATION D'ABEL. APPLICATIONS A LA MESURE DES MASSES VOLUMIQUES DANS LES SILLAGES]
L. Oudin and M. Jeanmaire 24 Nov. 1970 101 p refs In FRENCH
(ISL-21/70) Avail: NTIS HC $7.25

Different methods for solving the Abel function are presented and applied to the restitution of the refractive indexes in the hypersonic entropy wakes of 16 mm diameter spheres (3 to 5 km/sec velocity and 20 to 10 mm mercury pressure) and to the obtainment of the luminance distribution within a cylindrical radiating body. The reliability of the algorithm selected according to the fields of application is evaluated. The mathematical formulation, computation modes, software, and performance such as compilation time, accuracy, etc., are discussed. Author (ESRO)

N73-10325# Institut Franco-Allemand de Recherches, St. Louis (France).
NEW METHOD FOR CALCULATING THE TWO-DIMENSIONAL HYPERSONIC FLOW SHOCK LAYER AROUND A BLUNT BODY. FIRST PART: PRINCIPLES AND RESULTS [NOUVELLE METHODE DE CALCUL DE LA COUCHE DE CHOC DE L'ECOULEMENT HYPERSONIQUE BIDIMENSIONNEL AUTOUR D'UN CORPS EMOUSSE. PREMIERE PARTIE: PRINCIPE ET RESULTATS]
B. C. Jaeggy and Y. Bafour 1 Dec. 1971 56 p refs In FRENCH
(ISL-42/71) Avail: NTIS HC $5.00

An inverse method is described which uses the Von Mises coordinate system to calculate the shock layer of two-dimensional flow past an axisymmetric blunt body. Results obtained using this method are presented and compared with those obtained either by other methods or by experiments. The comparative study shows that results are satisfactory for Mach numbers higher than 10, but the method described is not suitable for Mach numbers less than 4. Author (ESRO)

N73-10326# Waterloopkundig Laboratorium, Delft (Netherlands).
TRANSIENTS IN COOLING WATER SYSTEMS OF THERMAL POWER PLANTS, PART 1 Ph.D. Thesis
Hemmat H. Safwat Apr. 1972 144 p refs Prepared in cooperation with Tech. Hogeschool Delft and Nuclear Power Plant Dodewaard 2 Vol.
(Publ-101-Pt-1) Avail: NTIS HC $9.25

The general aspects associated with transient conditions in the cooling water systems of thermal power plants which result from the pump trip out are examined. This covers the nature of the resulting hydraulic transients with regard to water hammer and water column separation. The investigation of three testing phases was carried out: horizontal line, siphon, and siphon with the condenser at its top. An experimental model was designed to simulate the pressure drops. Computer programs were prepared for numerical computation to predict the resulting pressures. The comparison of experimental and calculated results based on the method of characteristics has led to a new mathematical model. Numerical computation was done using this new model and experimental tests were carried out. New measured and calculated results were compared for the three testing phases. For figures and computer programs see N73-10327. Author (ESRO)

N73-10327# Waterloopkundig Laboratorium, Delft (Netherlands).
TRANSIENTS IN COOLING WATER SYSTEMS OF THERMAL POWER PLANTS, PART 2 Ph.D. Thesis
Hemmat H. Safwat Apr. 1972 160 p Prepared in cooperation with Tech. Hogeschool Delft and Nuclear Power Plant Dodewaard

2 Vol.
(Publ-101-Pt-2) Avail: NTIS HC $10.25
List of computer programs and figures are given for the coding water systems of thermal power plants. ESRO

N73-10328# Rome Univ. (Italy). Inst. of Physics.
ON THE PRESSURE IN THE SEA: A SIMPLE MODEL
C. Bardoz (Paris Univ.) and E. Salusti (Ist. Nazl. di Fis. Nucl., Rome) 22 May 1972 17 p refs
(Nota-Interna-377) Avail: NTIS HC $3.00
Some consequences of a simple model for pressure in the sea are developed. The assumption is made that the liquid mass is homogeneous, and that the water movements are small enough to allow the use of a linearized version of the Navier-Stokes equations, disregarding coriolis force. Author (ESRO)

N73-10329# Wisconsin Univ., Madison. Mathematics Research Center.
STATIONARY GRAVITY WAVES ON NON-UNIFORM FREE STREAMS
D. H. Peregrine May 1972 34 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-744995; MRC-TSR-1239) Avail: NTIS CSCL 20/4
Two-dimensional stationary gravity wave solutions are given for streams with various velocity profiles such that the velocity is zero at depth. Solutions are found by using linearized equations and it is noted that unlike most flows over a rigid boundary solutions may be found for all non-zero surface velocities. New finite-amplitude solutions are derived for a stream consisting of a thin surface jet. The waves may be very steep with rounded crests and are called shear waves. Physical examples are discussed. Author (GRA)

N73-10330# Army Foreign Science and Technology Center, Charlottesville, Va.
PROBLEMS IN CALCULATIONS OF TURBULENT BOUNDARY LAYERS
V. S. Avduzvskii and V. N. Kalashnik 14 Jan. 1972 19 p refs Transl. into ENGLISH from the book "Turbul. Techeniya" Moscow, 1970 p 110-119
(AD-745217; FSTC-HT-23-1058-72) Avail: NTIS CSCL 20/4
A survey of certain new turbulent boundary layer problems-related to the semiempirical calculational methods for the solution of the following aspects: friction, heat and mass transfer on the surface of streamlined bodies, and certain integral characteristics of the boundary layer-is conducted. The problems discussed are: turbulent boundary layer on a flat plate, boundary layer with a positive and negative pressure gradient, boundary layer on a porous surface, and new directions in the calculational methods. Author (GRA)

N73-10331# Stanford Univ., Calif. Dept. of Civil Engineering.
A NUMERICAL METHOD FOR STEADY STATE CAVITY FLOWS Final Report
Theodor R. Mogel and Robert L. Street Feb. 1972 123 p refs
(Contract N00014-67-A-0112-0046)
(AD-745346; SU-TR-155) Avail: NTIS CSCL 20/4
The objective of the work was to develop a numerical method for steady-state cavity flows to provide systematic correction of an initial, assumed free streamline position. The method is based on an inviscid, irrotational and incompressible flowfield, uses a numerical finite-difference representation with the fluid velocities as dependent variables, and obtains a solution by successive-overrelaxation. It has been implemented for two-dimensional fully cavitating flow past a vertical plate in a channel. Typical results and the computer program listing and output are given. Author (GRA)

N73-10332# Naval Postgraduate School, Monterey, Calif.
A STUDY OF SUPERSONIC CASCADE FLUTTER
Henry George Chalkley Jun. 1972 157 p refs
(AD-745838) Avail: NTIS CSCL 20/4
Supersonic flow past oscillating flat plate cascades with supersonic leading-edge locus is analysed using a linearized method of characteristics valid for arbitrary frequencies and an elementary analytical theory valid only for low frequencies of oscillation. These two methods are extensions of previous work by Teipel and Sauer for the single airfoil in an unbounded supersonic flow to the case of airfoils oscillating in cascade. Included is the determination of pressure distributions and both a two-degree-of-freedom (bending and torsion) flutter analysis and a single-degree-of-freedom (torsion) flutter analysis. Numerically determined flutter boundaries are presented for various primary parameters such as, Mach number, solidity, stagger angle, density ratio, structural damping coefficient, and elastic axis position. Author (GRA)

N73-10333# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
ANALYSIS OF THE INVISCID FLOW ABOUT A YAWED CONE: PRELIMINARY STUDIES
Gino Moretti and Maurizio Pandolfi May 1972 46 p refs
(Contract N00014-67-A-0438-0009; NR Proj. 061-135)
(AD-745782; PIBAL-72-18) Avail: NTIS CSCL 20/4
A numerical analysis of a supersonic, inviscid, steady flow past a blunt-nosed cone at yaw is presented. The numerical technique is suitable only for shockless flows. The purpose of the paper is twofold: to show how accurate results can be obtained with a coarse computational mesh and short running times, and discuss the physical evolution of the flow from a blunt-body pattern to a conical pattern. The formation of a vortical layer is followed in detail. Asymptotic results are compared with the results of an independent calculation for pointed cones. Author (GRA)

N73-10334# Naval Postgraduate School, Monterey, Calif.
FLOW OF DILUTE-POLYMER (POLYOX WSR-301) SOLUTIONS ABOUT CIRCULAR CYLINDERS Final Report
Turgut Sarpkaya, Peter G. Rainey, and Richard E. Kell 24 Jul. 1972 82 p refs
(AD-745763; NPS-59sL72072A) Avail: NTIS CSCL 07/4
Flow of the aqueous solutions of Polyox WSR-301, with concentrations of 1 ppm to 100 ppm, and of the pure solvent (tap and distilled water) about circular cylinders of diameters 0.5 in. to 1.97 in. was investigated. Direct and pressure integrated drag coefficients, pressure distribution, frequency spectrum, turbulence distribution, etc. were determined for flows of solutions at all levels of degradation and compared with the reference measurements made in pure-solvent flows. During the course of the investigation, a critically degraded solution was observed to cause, at a particular Re, an unforseen instability in the boundary layer and in all the other flow characteristics. This instability which most easily manifested itself in the form of an abrupt drag-force jump from a high subcritical value to a low supercritical value, became the central issue in the investigation. Author (GRA)

N73-10335# Army Foreign Science and Technology Center, Charlottesville, Va.
HEAT TRANSFER IN NON-NEWTONIAN FLUID FLOWS
P. G. Tsoii and Sh. Nyriddinov Mar. 1972 14 p refs Transl. into ENGLISH from the book "Teploobman pri Techenii Pepyutop-ob Skikh Zidkostei"
(AD-745702; FSTC-HT-23-205-72) Avail: NTIS CSCL 20/4
Various equations are presented which show relationships between stress and the displacement velocity for non-Newtonian fluid flows. The equation that shows the velocity profiles for a laminar hydrodynamically stable flow gives the results of a heat transfer study which used the integral heat balance method to study the flow of anomolous fluids obeying the rheological power law at considerable distance from the entry to the tube. The authors have shown that for various values the temperature curves hardly differ from each other, even if the velocity profiles differ considerable. Clearly, such results hold only in the case when friction heat is not taken into account. Author (GRA)

N73-10336# Johns Hopkins Univ., Baltimore, Md.
AN EXPERIMENTAL STUDY OF THE GROWTH OF MECHANICALLY GENERATED SURFACE WATER WAVES WHEN SUBJECTED TO A FULLY DEVELOPED TURBULENT CHANNEL AIRFLOW
W. Stanley Wilson Mar. 1972 104 p refs
(Contract N00014-67-A-0163-0006)
(AD-746493; Ref-72-2) Avail: NTIS CSCL 20/4
An experimental study was conducted to measure the growth

rates of mechanically generated surface water waves when subjected to fully developed turbulent channel airflow. The study was designed to test the accuracy of the growth rates predicted by the Miles 1962 Theory. Author (GRA)

N73-10337# Naval Undersea Research and Development Center, San Diego, Calif.
TURBULENT FLOW OF DRAG-REDUCING SUSPENSIONS Report for Oct. 1971 - Mar. 1972
J. W. Hoyt Jul. 1972 28 p refs
(NR Proj. 062-329)
(AD-746485; NUC-TP-299) Avail: NTIS CSCL 20/4

The friction-reducing properties of fiber suspensions were investigated. Fibers of asbestos, glass, and acrylic were found to greatly reduce the turbulent-flow resistance of both aqueous and non-aqueous suspending fluids. Pipe-flow and rotating-disk experiments show that fibers having the smallest diameter, and substantial length-to-diameter ratio gave the most friction reduction at the smallest weight concentration of fiber. An asbestos fiber gave 65 percent friction reduction in a small pipe-flow apparatus and 48 percent in the rotating-disk equipment (both being the maximum obtainable in the devices) at a suspension concentration of 500 ppm. Author (GRA)

N73-10338# Avco Corp., Wilmington, Mass.
STRATEGIC REENTRY TECHNOLOGY PROGRAM, PHASE 2 (STREET-AII). VOLUME 1: A TWO-LAYER MODEL OF HIGH SPEED TWO AND THREE DIMENSIONAL TURBULENT BOUNDARY LAYERS WITH PRESSURE GRADIENT AND SURFACE MASS INJECTION Final Report
B. L. Reeves Nov. 1971 79 p refs
(Contract F04701-71-C-0002)
(AD-743933; AVSD-0474-71-RR-Vol-1;
SAMSO-TR-72-25-Vol-1) Avail: NTIS CSCL 20D

A two-layer model of a three-dimensional compressible turbulent boundary layer is developed which is applicable to flows with pressure gradient and surface mass transfer. The model is based on the small cross-flow approximation in which the spreading metric is determined by the inviscid streamline pattern. A modified Mangler transformation is employed which permits transformation of the boundary layer equations to a two-dimensional form without transforming the turbulent stress or heat flux. Solution of the layer for velocity and enthalpy is obtained using mixing length theory and the thin layer Couette model. This report shows that the dynamics of the turbulent boundary layer depend on the coupling and interaction of the inner and outer layers. Several solutions and experimental comparisons are presented. Author (GRA)

N73-10339# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
LIQUID INJECTION INTO A SUPERSONIC STREAM Final Report, Jan. 1970 - Sep. 1971
C. L. Yates (APL) Mar. 1972 103 p refs
(AF Proj. 3012)
(AD-741887; AFAPL-TR-71-97-Vol-1) Avail: NTIS CSCL 21/5

Photographic data were obtained for the transverse injection of water and isopropyl alcohol from a flat-plate into airstreams having Mach numbers of 1.62 and 2.72. Jet/freestream dynamic pressure ratio, jet Reynolds and Weber numbers, and free-stream Reynolds number were varied. Improved empirical equations for jet penetration and width were developed and substantiated for two sets of test conditions by detailed flowfield mapping 50 jet diameters downstream using pitot-pressure, cone-static-pressure, and heated sampling probes. An improved theoretical analysis was obtained. Author (GRA)

N73-10340# Hydronautics, Inc., Laurel, Md.
THE SMALL FROUDE NUMBER PARADOXES AND WAVE RESISTANCE AT LOW SPEEDS
Gedeon Dagan Jun. 1972 65 p refs
(Contract N00014-71-C-0080; NR Proj. 062-266)
(AD-746191; TR-7103-4) Avail: NTIS CSCL 20/4

Two basic asymptotic expansions of the equations of two-dimensional free-surface gravity flow past a body are first discussed: (1) the thin body, and (2) the naive small Froude number expansions. It is shown that different solutions are obtained for small Froude number and thin body from (1) and (2) (the first paradox), because (2) is not uniform in the downstream region of the flow domain, where waves are concentrated. Moreover, the thin body expansion, which leads at first order to the usual linearized wavemaking approximation, is not uniform as the Froude number tends to zero (the second paradox). By using the exact solution of a model problem, linearized free-surface conditions leading to uniform small Froude number solutions have been derived. Author (GRA)

N73-10341# Illinois Univ., Urbana. Coordinated Science Lab.
AN IMPLICIT FOURTH ORDER DIFFERENCE METHOD FOR VISCOUS FLOWS
D. S. Watanaba and J. R. Flood Jun. 1972 21 p refs
(Contracts DAAB07-67-C-0199; N00014-67-A-0305-0019)
(AD-746389; R-572; UILU-ENG-72-2233) Avail: NTIS CSCL 20/4

An implicit finite difference scheme for viscous flows is presented. The scheme is based on Simpson's rule and two-point Hermite interpolation, has a truncation error of O(delta sup 5) for fixed delta t/delta x, and is unconditionally stable according to a Fourier stability analysis. Numerical solutions of the Burger's, Euler, and Navier-Stokes equations are presented to illustrate the order and accuracy of the scheme. Author (GRA)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N73-10342 National Lending Library for Science and Technology, Boston Spa (England).
APERIODIC PROCESSES IN THE STRATOSPHERE OF THE NORTHERN HEMISPHERE
H. P. Pogosjan, A. A. Pavlovskaja, and G. V. Letnikov 10 Nov. 1970 158 p refs Transl. into ENGLISH of Russian publ., Leningrad, Gidrometeoizdat, 1969 166 p No diagrams etc.; to be used in conjunction with original paper
(NLL-M-20086-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 16 NLL photocopy coupons

The formation of seasonal temperature and circulation fields in the stratosphere is investigated. Aperiodic processes accompanied by the splitting of winter polar cyclones into two parts and sudden rises of temperature increases are discussed. The influence of tropospheric processes on temperature and circulation variations in the lower half of the stratosphere is demonstrated by an analysis of the formation of temperature and geopotential fields in the troposphere and stratosphere and by a comparison of the geopotential value on the 300 mb surface with those on the 200, 100, 50, 30, and 10 mb surfaces. It is possible to forecast the geopotential and wind fields in the lower and middle stratosphere twenty-four hours in advance. The stratospheric temperature increases during winter are not influenced by solar activity. Author

N73-10343 Department of Energy, Mines and Resources, Ottawa (Ontario). Earth Physics Branch.
RECORD OF OBSERVATIONS AT GREAT WHALE RIVER MAGNETIC OBSERVATORY, 1969
G. Jansen VanBeek and H. R. Reny 1972 77 p refs
(M70-43/3) Copyright. Avail: Issuing Activity

A history of the Great Whale River, Canada, magnetic observatory with details on the observatory buildings, equipment, and procedures is presented. The specifications of the equipment and the applications are discussed. Data resulting from observations of geomagnetism for the year 1969 are consolidated in tabular form. Author

N73-10344 Department of Energy, Mines and Resources, Ottawa (Ontario). Earth Physics Branch.
RECORD OF OBSERVATIONS AT MOULD BAY MAGNETIC OBSERVATORY, 1969
G. Jansen VanBeek and W. Piche 1972 79 p refs
(M70-43/4) Copyright. Avail: Issuing Activity

The equipment installed in a combined magnetic and seismic observatory at Mould Bay, Canada is described. Specific items of equipment include photographic variometers, storm recorders, and proton precession magnetometer. The procedures for operating the Ruska variometers to determine temperature coefficients are presented. Tables and graphs are developed to show the magnetic data acquired during calendar year 1969.
Author

N73-10345 Department of Energy, Mines and Resources, Ottawa (Ontario). Earth Physics Branch.
RECORD OF OBSERVATIONS AT BAKER LAKE MAGNETIC OBSERVATORY, 1969
G. Jansen VanBeek and H. R. Reny 1972 77 p refs
(M70-43/2) Copyright. Avail: Issuing Activity

A history of the Baker Lake, Canada, magnetic observatory with details on the observatory buildings, equipment, and procedures is presented. The specifications of the equipment and the applications are discussed. Data resulting from observations of geomagnetism for the year 1969 are consolidated in tabular form.
Author

N73-10346 Department of Energy, Mines and Resources, Ottawa (Ontario). Earth Physics Branch.
MAGNETIC ANOMALY MAPS OF BRITISH COLUMBIA AND THE ADJACENT PACIFIC OCEAN
G. V. Haines and W. Hannaford 1972 17 p refs
(M70-42/7) Copyright. Avail: Issuing Activity

A three-component aeromagnetic survey of British Columbia and the northeastern Pacific Ocean was carried out in early 1969. The survey data are in the form of averages over 30 seconds of time, or roughly 3.5 km of flight track. The International Geomagnetic Reference Field (IGRF) was removed from these data, and the resulting residuals plotted as profiles. A 3rd-degree polynomial was fitted to the survey data by least-squares to determine how well the IGRF represents the average regional field over the survey area. The polynomial was also used to obtain vector residuals, which require a residual mean close to zero. Lines of zero gradient in the component parallel to the flight tracks are also given.
Author

N73-10347*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLICATION OF ERTS AND EREP IMAGES TO GEOLOGICAL INVESTIGATIONS OF THE BASIN AND RANGE: COLORADO PLATEAU BOUNDARY IN NORTHWESTERN AND NORTH-CENTRAL ARIZONA Progress Report, 15 Aug. - 15 Oct. 1972
A. F. H. Goetz, Principal Investigator 15 Oct. 1972 5 p Sponsored by NASA
(E72-10157; NASA-CR-128293) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N73-10348*# North Carolina State Univ., Raleigh. Dept. of Geosciences.
UTILIZATION OF ERTS-1 DATA IN GEOLOGICAL EVALUATION, REGIONAL PLANNING, FOREST MANAGEMENT, AND WATER MANAGEMENT IN NORTH CAROLINA
Charles W. Welby, Principal Investigator Sep. 1972 1 p Sponsored by NASA
(E72-10167; NASA-CR-128351) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-10349*# Grumman Ecosystems Corp., Bethpage, N.Y.
TO DETERMINE THE BOUNDARIES OF AIRCRAFT AND SPACECRAFT DATA WITHIN WHICH USEFUL WATER QUALITY INFORMATION CAN BE OBTAINED Progress Report, 1 Sep. - 1 Nov. 1972
W. C. Coulbourn, Principal Investigator 8 Nov. 1972 3 p (Contract NAS5-21811)
(E72-10168; NASA-CR-128359; GEC72L-1090) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-10350*# Corps of Engineers, Vicksburg, Miss. Waterways Experiment Station.
SEDIMENT PATTERN CORRELATIONS WITH INFLOW AND TIDAL ACTION Progress Report, 1 Aug. - 30 Sep. 1972
Warren E. Grabau, Principal Investigator 19 Oct. 1972 3 p Sponsored by NASA
(E72-10169; NASA-CR-128360) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-10351*# National Environmental Satellite Service, Washington, D.C.
EVALUATION OF ERTS DATA FOR CERTAIN HYDROLOGICAL USES Phase Report, Aug. - Sep. 1972
Donald R. Wiesnet, Principal Investigator and David F. McGinnis Sep. 1972 4 p Sponsored by NASA
(E72-10170; NASA-CR-128361) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-10352*# Long Island Univ., Greenvale, N.Y. Science Engineering Research Group.
AN INTERDISCIPLINARY STUDY OF THE ESTUARINE AND COASTAL OCEANOGRAPHY OF BLOCK ISLAND SOUND AND ADJACENT NEW YORK COASTAL WATERS Progress Report, period ending 15 Oct. 1971
Edward Yost, Principal Investigator 20 Oct. 1972 2 p (Contract NAS5-21792)
(E72-10171; NASA-CR-128362) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-10353*# Long Island Univ., Greenvale, N.Y. Science Engineering Research Group.
AN INTERDISCIPLINARY STUDY OF THE ESTUARINE AND COASTAL OCEANOGRAPHY OF BLOCK ISLAND SOUND AND ADJACENT NEW YORK COASTAL WATERS Progress Report, period ending 15 Aug. 1972
Edward Yost, Principal Investigator 17 Aug. 1972 1 p (Contract NAS5-21792)
(E72-10172; NASA-CR-128363) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-10354*# Nebraska Univ., Lincoln.
PROPOSAL TO EVALUATE THE USE OF ERTS-A IMAGERY IN MAPPING AND MANAGING SOIL AND RANGE RESOURCES IN THE SAND HILLS REGION OF NEBRASKA Progress Report
James V. Drew, Principal Investigator 31 Oct. 1972 8 p (Contract NAS5-21756)
(E72-10175; NASA-CR-128412) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. Visual examination of RB-57F color infrared imagery of range sites within Test Site 313 indicates that early season imagery will show significant differences in appearance of sub-irrigated sites as compared to dry valley sites. Differences appear to be significant also when comparing the previous two sites to sands sites. Comparison of existing soil map soils delineations with vegetative growth patterns shows reasonably good agreement between the two patterns over rather broad areas. Visual examination of ERTS-1 imagery has also shown that rangeland burned by prairie fire within the last six months can be distinguished. Three confirmed fire areas have been shown on the imagery. Since only broad estimates of burned acres are available, more accurate acreage measurements will be attempted. Known acreage of burned areas will be of value to those agencies responsible for deferred grazing payments to land owners. The relative speed with which this acreage information would become available to these agencies through ERTS-1 imagery would be of much benefit.
A.L

N73-10355*# Oregon State Univ., Corvallis.
LANDFORM VEGETATION RELATIONSHIPS IN SOUTHERN ARIZONA
Barry J. Schrumpf, Principal Investigator and David A. Mouat 20 Oct. 1972 3 p Presented at Intern. Conf. on Remote Sensing in Arid Lands, Tucson, Ariz., 9 Nov. 1972
(Contract NAS5-21831)
(E72-10176; NASA-CR-128413) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-10356*# Tennessee Univ., Knoxville. Dept. of Geography.
GEOGRAPHIC APPLICATIONS OF ERTS-1 IMAGERY TO RURAL LANDSCAPE CHANGE
John B. Rehder, Principal Investigator [1972] 4 p Presented at Ann. Meeting of Southeastern Div. of Assoc. of Am. Geographers, Miami, Fla., 19-21 Nov. 1972 Submitted for publication Sponsored by NASA
(E72-10177; NASA-CR-128371) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-10357*# Earth Satellite Corp., Washington, D.C. Geosciences and Environmental Applications Div.
APPLICATION OF ERTS-A DATA TO THE PROTECTION AND MANAGEMENT OF NEW JERSEY'S COASTAL ENVIRONMENT Progress Report, 1 Jul. - 1 Sep. 1972
Roland S. Yunghans, Principal Investigator, Edward B. Feinberg, and Frank J. Wobber, Principal Investigator 29 Sep. 1972 4 p refs Prepared in cooperation with N. J. Dept. of Environ. Protection
(Contract NAS5-21765)
(E72-10178; NASA-CR-128373) Avail: NTIS HC $3.00 CSCL 08C

The author has identified the following significant results. Apparent sewage sludge disposal by barge has been detected approximately 12 miles offshore in an area with an approximate radius of 2.5 nautical miles. Verification is underway to determine whether this dumping is within one of the approved dump sites in the Bight. Analysis of all available historical and routine meteorological data in correlation with the observed phenomenon is necessary before final conclusions can be reached with respect to the effects of currents on the disposal of dumped wastes. Four effluent plumes emanating from the shoreline just south of Sandy Hook were observed and are moving in a southerly direction. Another plume is evident north of Barnegat Inlet and is moving almost directly offshore. This suggests that the more northerly plumes are under the influence of the tidal regime around New York Harbor much more than are the plumes further south along the New Jersey coast. Of further interest are what appear to be an internal wave phenomena approximately 75 miles east of the New Jersey coast. This same sort of phenomena has been observed repetitively off the coast of Oregon.

N73-10358*# Department of Agriculture, Washington, D.C.
CROP IDENTIFICATION AND ACREAGE MEASUREMENT UTILIZING ERTS IMAGERY Progress Report, 20 Aug. - 19 Oct. 1972
Donald H. VonSteen, Principal Investigator 19 Oct. 1972 13 p Sponsored by NASA
(E72-10179; NASA-CR-128326) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report. The microdensitometer will be used to analyze data acquired by ERTS-1 imagery. The classification programs and software packages have been acquired and are being prepared for use with the information as it is received. Photo and digital tapes have been acquired for coverage of virtually 100 percent of the test site areas. These areas are located in South Dakota, Idaho, Missouri, and Kansas. Hass 70mm color infrared, infrared, black and white high altitude aerial photography of the test sites is available. Collection of ground truth for updating the data base has been completed and a computer program written to count the number of fields and give total acres by size group for the segments in each test site. Results are given of data analysis performed on digitized data from densitometer measurements of fields of corn, sugar beets, and alfalfa in Kansas. A.L.

N73-10359*# Texas Instruments, Inc., Dallas.
EVALUATION OF COMMERCIAL UTILITY OF ERTS-A IMAGERY IN STRUCTURAL RECONNAISSANCE FOR MINERALS AND PETROLEUM Progress Report, 29 Aug. - 31 Oct. 1972
Donald F. Saunders, Principal Investigator 7 Nov. 1972 5 p Sponsored by NASA
(E72-10180; NASA-CR-128327) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N73-10360*# Michigan Univ., Ann Arbor. Willow Run Labs.
AN ERTS MULTISPECTRAL SCANNER EXPERIMENT FOR MAPPING IRON COMPOUNDS
Robert K. Vincent, Principal Investigator 6 Nov. 1972 11 p refs Presented at 8th Symp. on Remote Sensing of Environment Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contracts NAS5-21783; NAS9-9784; BM-HO-220064)
(E72-10181; NASA-CR-128330; Rept-011676-1-S-SA) Avail: NTIS HC $3.00 CSCL 08I

There are no author-identified significant results in this report. An experimental plan for enhancing spectral features related to the chemical composition of geological targets in ERTS multispectral scanner data is described. The experiment is designed to produce visible-reflective infrared ratio images from ERTS-1 data. Iron compounds are promising remote sensing targets because they display prominent spectral features in the visible-reflective infrared wavelength region and are geologically significant. The region selected for this ERTS experiment is the southern end of the Wind River Range in Wyoming. If this method proves successful it should prove useful for regional geologic mapping, mineralogical exploration, and soil mapping. It may also be helpful to ERTS users in scientific disciplines other than geology, especially to those concerned with targets composed of mixtures of live vegetation and soil or rock. A.L.

N73-10361*# Oregon State Univ., Corvallis. School of Agriculture.
COMPARATIVE EVALUATION OF ERTS-A IMAGERY FOR RESOURCE INVENTORY IN LAND-USE PLANNING Progress Report, period ending 31 Oct. 1972
Gerald H. Simonson, Principal Investigator 10 Nov. 1972 22 p Sponsored by NASA
(E72-10182; NASA-CR-128331) Avail: NTIS HC $3.25 CSCL 08G

There are no author-identified significant results in this report. The overall objectives of this program are: (1) use of multidiscipline team approach to determine features that can be successfully monitored by ERTS-1 imagery for resource inventory, planning, land use zoning, and resource development; and (2) using carefully selected sample areas, develop a comprehensive resource inventory mapping system for use in planning, zoning, and resource development. Progress has included compilation and organization of ground truth data and observations in the primary study area of Crook County; resource inventory legend development; assembly and testing of color enhancement equipment; development and adaption of programs for digital data processing; and quick-look evaluations of initial ERTS-1 imagery for Oregon. A.L.

N73-10362*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
STUDIES OF IMAGES OF SHORT LIVED EVENTS USING ERTS DATA Progress Report, 1 Sep. - 31 Oct. 1972
William A. Deutschman, Principal Investigator 31 Oct. 1972 2 p
(Contract NAS5-21858)
(E72-10183; NASA-CR-128332) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-10363*# Oregon State Univ., Corvallis.
INVENTORY AND MONITORING OF NATURAL VEGETATION AND RELATED RESOURCES IN AN ARID ENVIRONMENT BY THE USE OF ERTS-A IMAGERY Progress Report, period ending 31 Oct. 1972
Barry J. Schrumpf, Principal Investigator 9 Nov. 1972 8 p
(Contract NAS5-21831)
(E72-10184; NASA-CR-128382; PR-1) Avail: NTIS HC $3.00 CSCL 08F

The author has identified the following significant results. The southern Arizona test site includes vegetation representing shrub types of the Sonoran and Chihuahuan Deserts and Arizona chaparral. Also represented are grassland types of the desert grassland, juniper, and oak woodland types, and coniferous forest

types. Relationships between plant species and selected terrain features are given along with the terrain feature classes used for the analyses. The purpose for determining the degree to which such relationships exist is to develop a body of knowledge to constitute the associated evidence that a photointerpreter may consult when interpreting vegetation subjects on small scale imagery. Imagery of this scale class contains little image detail which can be interpreted directly in terms of vegetation. On the other hand, some terrain features are the most salient features of that same imagery. Exploitation of those features for vegetation identification, inventory, and analysis can be accomplished only after establishing the existence of ecological relationships.

N73-10364*# Earth Satellite Corp., Berkeley, Calif.
A SCHEME FOR THE UNIFORM MAPPING AND MONITORING OF EARTH RESOURCES AND ENVIRONMENTAL COMPLEXES USING ERTS-1 IMAGERY Progress Report, 1 Sep. - 31 Oct. 1972
Charles E. Poulton, Principal Investigator and Robin I. Welch 10 Nov. 1972 6 p Sponsored by NASA
(E72-10185; NASA-CR-128383; PR-2) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-10365*# Earth Satellite Corp., Berkeley, Calif.
INVESTIGATION TO DEVELOP A MULTISTAGE FOREST SAMPLING INVENTORY SYSTEM USING ERTS-1 IMAGERY Bimonthly Progress Report
Philip G. Langley, Principal Investigator 10 Nov. 1972 4 p Sponsored by NASA
(E72-10186; NASA-CR-128384) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-10366*# Stanford Research Inst., Calif.
STUDY OF TIME LAPSE DATA PROCESSING FOR DYNAMIC HYDROLOGIC CONDITIONS Progress Report, 6 Sep. - 6 Nov. 1972
Sidney M. Serebreny, Principal Investigator 6 Nov. 1972 8 p
(Contract NAS5-21841)
(E72-10187; NASA-CR-128385) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-10367*# Dartmouth Coll., Hanover, N.H. Dept of Geography.
LAND USE IN NORTHERN MEGALOPOLIS Progress Report
Robert B. Simpson 10 Nov. 1972 3 p refs
(Contract NAS5-21749)
(E72-10188; NASA-CR-128386; PR-3) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-10368*# Radio Corp. of America, Princeton, N.J.
METEOROLOGICAL UTILITY OF HIGH RESOLUTION MULTI-SPECTRAL DATA Progress Report, period ending 31 Oct. 1972
John M. Danko, Principal Investigator 31 Oct. 1972 1 p
(Contract NAS5-21741)
(E72-10189; NASA-CR-128387) Avail: NTIS HC $3.00 CSCL 04B

There are no author-identified significant results in this report.

N73-10369*# International Imaging Systems, Mountain View, Calif.
PROPOSAL FOR OCEAN WATER COLOR ASSESSMENT FROM ERTS-A RBV AND MSS IMAGERY Progress Report, period ending 7 Nov. 1972
Donald S. Ross, Principal Investigator 7 Nov. 1972 3 p Sponsored by NASA
(E72-10190; NASA-CR-128388) Avail: NTIS HC $3.00 CSCL 08J

There are no author-identified significant results in this report.

N73-10370*# Servicio Geologico de Bolivia, La Paz.
EARTH RESOURCES TECHNOLOGY SATELLITE DATA COLLECTION PROJECT ERTS-A BOLIVIA Progress Report, Jul. - Oct. 1972
Carlos E. Brockmann, Principal Investigator Oct. 1972 5 p Sponsored by NASA
(E72-10191; NASA-CR-128389) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-10371*# Argus Exploration Co., Los Angeles, Calif.
A RECONNAISSANCE SPACE SENSING INVESTIGATION OF THE CRUSTAL STRUCTURE FOR A STRIP FROM THE EASTERN SIERRA NEVADA TO THE COLORADO PLATEAU: APRIL 1971 Progress Report, 1 Sep. - 31 Oct. 1972
Ira C. Bechtold, Principal Investigator and Mark A. Liggett 9 Nov. 1972 11 p
(Contract NAS5-21809)
(E72-10192; NASA-CR-128390) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. An area of anomalous linear topographic grain and color expressions was recognized in Apollo 9 and ERTS-1 imagery along the Colorado River of northwestern Arizona and southern Nevada. Field reconnaissance and analysis of U-2 photography has shown the anomaly to be a zone of north to north-northwest trending dike swarms and associated granitic plutons. The dikes vary in composition from rhyolite to diabase, with an average composition nearer rhyolite. Shearing and displacement of host rocks along dikes suggest dike emplacement along active fault zones. Post-dike deformation has resulted in shearing and complex normal faulting along a similar north-south trend. The epizonal plutonism and volcanism of this north-south belt appears to represent a structurally controlled volcanogenic province which ends abruptly in the vicinity of Lake Mead at a probable eastern extension of the Las Vegas Shear Zone. The magnitude and chronology of extensional faulting and plutonism recognized in the north-south zone, support the hypothesis that the Las Vegas Shear Zone is a transform fault separating two areas of crustal spreading.

N73-10372*# Indiana Geological Survey, Bloomington.
STUDY OF THE APPLICATION OF ERTS-A IMAGERY TO FRACTURE-RELATED MINE SAFETY HAZARDS IN THE COAL MINING INDUSTRY Progress Report, 1 Sep. - 31 Oct. 1972
Charles E. Wier, Frank J. Wobber, Principal Investigators (Earth Satellite Corp.), Orville R. Russell (Earth Satellite Corp.), and Rojer V. Amato (Earth Satellite Corp.) 8 Nov. 1972 3 p refs
(Contract NAS5-21795)
(E72-10193; NASA-CR-128391; PR-2) Avail: NTIS HC $3.00 CSCL 08K

The author has identified the following significant results. Various data compilation and analysis activities in support of ERTS-1 imagery interpretation are in progress or are completed. These include the compilation of mine accident data, areas of mine roof instability and the analysis of high altitude color infrared photography and low altitude color and color infrared photography which was acquired by NASA in support of the project. The photography reveals that many fracture lineaments are detectable through a varied thickness of glacial till. These data will be compiled on a series of 1:250,000 scale base maps and evaluated for a correlation between fracture zones and mine accidents and rooffalls. Due to high occurrence of cloud cover in the project area and to the delay in imagery shipments, little progress has been made in the analysis of ERTS-1 imagery.

N73-10373*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
MAPPING OF THE MAJOR STRUCTURES OF THE AFRICAN RIFT SYSTEM Progress Report 1 Sep. - 31 Oct. 1972
Paul Mohr, Principal Investigator 31 Oct. 1972 3 p
(Contract NAS5-21748)
(E72-10194; NASA-CR-128406) Avail: NTIS HC $3.00 CSCL 08K

The author has identified the following significant results. ERTS-1 imagery of the African rift system resolves the major Cenozoic faults, zones of warping, and the associated volcanism. It also clearly depicts the crustal grain of the Precambrian rocks where these are exposed. New structural features, or new properties of known features such as greater extent, continuity, linearity, etc., are revealed by the ERTS-1 imagery. This applies

to the NE-SW fracture zones in Yemen, the Aswa mylonite zone at the northern end of the Western Rift, the Nandi fault of western Kenya, the arcuate faults of the Elgeyo escarpment in the Gregory rift, and hemi-basins of warped Tertiary lavas on the Red Sea margin of Yemen, matching those of the Ethiopian plateau-Afar margin. A tentative scheme is proposed, relating the effect on the pattern of Cenozoic faulting of the degree of obliquity to Precambrian structural trend. Some ground-mapped lithological boundaries are obscure on ERTS-1 imagery. The present approaches to mapping of Precambrian terrain in Africa may require radical revision with the input of satellite imagery.

N73-10374*# Minnesota Univ., Minneapolis.
LAND USE MANAGEMENT IN MINNESOTA Progress Report, 1 Sep. - 31 Oct. 1972
Joseph E. Sizer, Principal Investigator 31 Oct. 1972 3 p
Sponsored by NASA
(E72-10195; NASA-CR-128410) Avail: NTIS HC $3.00 CSCL 08M

The author has identified the following significant results. Preliminary analysis of bulk imagery suggests that the forty-acre data cell used in the Minnesota Land Management Information Systems (MLMIS) can be utilized in interpretation of ERTS-1 data. High quality bulk images of the Twin Cities metropolitan area suggest that detail in urban land use patterns is much greater than originally anticipated. This implies a greater work effort in this area than was planned. Furthermore, the forest classes of land use can also be usefully divided into subcategories. Preliminary analysis of one rather low quality image also indicates that subclasses of wetlands can be identified. Prospects are bright for improving the potential detail that ERTS-1 can contribute to MLMIS.

N73-10375*# Delaware Univ., Newark.
DYNAMICS OF PLANKTON POPULATIONS IN UPWELLING AREAS. CHLOROPHYLL MEASUREMENTS IN UPWELLING AREAS BY REMOTE SENSING (CURS) Progress Report, Jun. - Aug. 1972
Karl-Heinz Szekielda, Principal Investigator Sep. 1972 11 p
(Contract NAS5-21784)
(E72-10196; NASA-CR-128440) Avail: NTIS HC $3.00 CSCL 08A

There are no author-identified significant results in this report.

N73-10376*# Earth Satellite Corp., Berkeley, Calif.
MINERAL EXPLORATION POTENTIAL OF ERTS-1 DATA Progress Report
William A. Brewer, Principal Investigator 8 Nov. 1972 6 p
(Contract NAS5-21745)
(E72-10197; NASA-CR-128441) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. Preliminary results of examinations of the ERTS-1 imagery are: (1) although the interpretation was accomplished on a scale of 1:1,000,000, X2 magnification was necessary for greater detail; (2) channel 7 of MSS imagery gave better contrast for detecting geological features; (3) topographic features located south of Phoenix easily identified from surrounding alluvium; (4) granites and granite gniesses in vicinity of Newman Peak cannot be subdivided from examing ERTS-1 imagery; (5) one major lineation, made up of many parallel lineations, is noticeable just north of Lake Pleasant that extends for approximately 100 miles in a northern direction; (6) most of the regional lineations fall into three general directions: northeast, northwest, and north-south; and (7) comparison between image numbers ERTS E 1049-17324-7 and ERTS E 1067-17324-7 is that the latter imagery acquired 18 days later, has higher contrast especially in regards to tracing faults that occur in alluvial fans.

N73-10377*# Ohio State Univ. Research Foundation, Columbus. Dept. of Geodetic Science.
IMPROVEMENT OF A GEODETIC TRIANGULATION THROUGH CONTROL POINTS ESTABLISHED BY MEANS OF SATELLITE OR PRECISION TRAVERSING
Narenda K. Saxena Jun. 1972 86 p refs
(Grant NGR-36-008-093; OSURF Proj. 2514)
(NASA-CR-128402; Rept-177) Avail: NTIS HC $6.50 CSCL 08B

Whether any significant increment to accuracy could be transferred from a super-control continental net (continental satellite net or super-transcontinental traverse) to the fundamental geodetic net (first-order triangulation) is discussed. This objective was accomplished by evaluating the positional accuracy improvement for a triangulation station, which is near the middle of the investigated geodetic triangulation net, by using various station constraints over its geodetic position. This investigation on a 1858 kilometer long triangulation chain shows that the super-control net can provide a useful constraint to the investigated geodetic triangulation net, and thus can improve it only when the accuracy of super-control net is at least 1 part in 500,000.
Author

N73-10378*# California Univ., Los Angeles. Plasma Physics Group.
HIGH FREQUENCY HALL CURRENT INSTABILITY
K. Lee, C. F. Kennel, and J. M. Kindel Aug. 1970 14 p refs
(Grant NGR-05-007-116)
(NASA-CR-130078; R-75) Avail: NTIS HC $3.00 CSCL 04A

The Hall current electrojet instability was studied to determine if it generates VLF hiss in the auroral zone of magnetic substorms. Using the kinetic equations with particle conserving Krook collision operator for electrons and ions, and Poisson's equation, it is shown that in the low frequency region, the range of frequency of unstable modes increases as the electron density increases, and that the high frequency component must be taken into account in calculations of turbulent saturation of the Hall current instability driven beyond threshold. It is concluded that Hall currents can generate waves in the VLF hiss frequency band which are related to local auroral electrojet activity. F.O.S.

N73-10379*# Colorado Univ., Boulder.
AIRGLOW AND AURORAL EXPEDITION ABOARD THE CV-990 AIRCRAFT
30 Aug. 1972 35 p refs
(Grant NGR-06-003-110)
(NASA-CR-128392) Avail: NTIS HC $3.75 CSCL 04A

The observations with a scanning spectrometer and a single channel photometer, in the wavelength interval between 3100 and 6300 angstroms, are presented for the airborne auroral expedition in November and December 1969. The instrumentation and instrument calibration are described. F.O.S.

N73-10380*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A MODEL FOR THE TEMPERATURE AND COMPOSITION EFFECTS IN THE SEMIANNUAL VARIATIONS OF THE THERMOSPHERIC DENSITY
Hans G. Mayr and Hans Volland (Bonn Univ.) Aug. 1971 18 p refs Submitted for publication
(NASA-TM-X-65835; X-621-71-333) Avail: NTIS HC $3.00 CSCL 04A

A model is proposed in which latitudinal variations in composition and temperature are used to interpret the semiannual effect in the thermospheric density. Two heat sources are postulated for the semiannual circulation: one at high latitudes associated with the semiannual component in the occurance of magnetic storms and a second weaker one that peaks at the equator associated with the semiannual migration between both hemispheres. Depending on the relative magnitude of these sources, the latitude regions in which composition and temperature effects dominate vary. The temperature effects however should be expected weakest at low to mid latitudes where the relative concentration of atomic oxygen is enriched during equinox. At high latitudes the semiannual temperature component would peak; associated with an oxygen depletion in the lower thermosphere during equinox. In combining these features it is shown that the total atmospheric density could still exhibit a relatively small latitude dependence in the semiannual component with the tendency to decrease at high latitudes, in agreement with observations. Author

N73-10381# Institut Royal Meteorologique de Belgique, Brussels.
HYDROMETEOROLOGIC STUDY OF PRECIPITATION IN BELGIAN HYDROGRAPHIC BASINS. 2: VIROIN BASIN [ETUDE HYDROMETEOROLOGIQUE DES PRECIPITATIONS SUR LES BASSINS HYDROGRAPHIQUES BELGES. 2:

BASSIN DU VIROIN]
Franz Bultot, Gerard L. Dupriez, and Nicole Bleiman 1971 70 p refs In FRENCH
(IRMB-Publ-A-70-2) Avail: NTIS HC $5.50

The physiographic characteristics of the Viroin basin in Belgium are described. Monthly, seasonal, annual, and daily variations in water flow were analyzed. Dry and rainy periods and homogeneity of precipitation in the basin are discussed. The spatial distribution of precipitation in the basin is also considered. Transl. by K.P.D.

N73-10382# National Research Council of Canada, Ottawa (Ontario). Hydraulics Lab.
NUMERICAL MODEL STUDIES OF THE ST. LAWRENCE RIVER
D. Prandle and N. Crookshank Jul. 1972 114 p refs
(NRC-12764; MH-109) Avail: NTIS HC $7.75

Tidal propagation in the St. Lawrence River was studied using three numerical models. For simulation of the entire 330 mile tidal reach a one-dimensional numerical model was used. A detailed investigation of a smaller section of the river was made using a two-dimensional model. This model was combined with the one-dimensional model to provide convenient boundary conditions. This technique was also used in studying the circulation of the lower estuary with a two-dimensional model. The simulation by the one-dimensional model was considered sufficiently accurate for most engineering purposes being limited mainly by the accuracy of the available field data. The simulation by the two-dimensional models was of an equivalent degree of accuracy except in those areas where marked vertical stratification occurred. Author

N73-10383# Finnish Meteorological Inst., Helsinki.
MAGNETIC RESULTS FROM NURMIJAERVI GEOPHYSICAL OBSERVATORY, NO. 13, 1971
1972 32 p
Avail: NTIS HC $3.75

Hourly data, and monthly and annual means of declination and horizontal and vertical intensity are tabulated. In 1971 absolute measurements of horizontal and vertical intensity were taken with a vector-protonmagnetometer. The absolute level of the declination was determined with two Askania-Reisetheodolites. The QHMs nos. 84, 85, 86, 286, and 287 were also used regularly for the base-line determinations. The QHMs and the protomagnetometer were compared with Danish standards at the Dombaes Observatory in Norway in June 1971. The Rude Skov and Nurmijaeri standards for total and horizontal intensities were found to be the same to 0.5 gamma. Author

N73-10384# Technische Universitaet, Brunswick (West Germany). Inst. fuer Geophysik und Meteorologie.
THE FORSTER SOUND EXPERIMENT E2 IN HELIOS A AND B [DAS FOERSTERSONDENEXPERIMENT E2 IN HELIOS A UND B]
Guenter Musmann and Arnold Maier 1972 140 p refs In GERMAN
(GAMMA-21) Avail: NTIS HC $9.00

Electrical and mechanical properties of the three-axle vector magnetometer for HELIOS A and B sounding experiment E2 are discussed. The experiment is designed to continuously observe the interplanetary magnetic field. Emphasized are observations of the spiral structure and magnetic field discontinuities in relation to distance from sun as well as shock wave structures and tangential discontinuities. Transl. by G.G.

N73-10385# National Physical Lab., New Delhi (India). Radio Propagation Unit.
SOLAR AND GEOPHYSICAL DATA, PART 2, JANUARY 1972
Jan. 1972 12 p
(RRC-A-199-Pt-2; SG-72) Avail: NTIS HC $3.00

Predicted and observed solar and geophysical data for December 1971 are presented in tables and graphs. The data include sunspot numbers, solar flux, solar flares and their effects, magnetic storms, and SID effects. Author

N73-10386# National Physical Lab., New Delhi (India).
SOLAR AND GEOPHYSICAL DATA, PART 2, MARCH 1972
Mar. 1972 22 p
(RRC-A-201-Pt-2; SG-74) Avail: NTIS HC $3.25

Ionospheric data obtained with vertical incidence soundings technique from weather stations in India are presented. The ionospheric data are supplemented with solar and geophysical data. The names and locations of the stations participating in the data acquisition are included. Author

N73-10387# National Physical Lab., New Delhi (India). Radio Propagation Unit.
SOLAR AND GEOPHYSICAL DATA, PART 2, FEBRUARY 1972
Feb. 1972 15 p
(RRC-A-200-Pt-2; SG-73) Avail: NTIS HC $3.00

Predicted and observed solar and geophysical data for January 1972 are presented in tables and graphs. The data include sunspot numbers, solar flux, solar flares and their effects, magnetic storms, and SID effects. Author

N73-10388# Technische Universitaet, Brunswick (West Germany). Inst. fuer Geophysik und Meteorologie
MAGNETOTELLURIC MEASUREMENTS IN THE RHINE VALLEY AND THEIR EXPLANATION WITH TWO DIMENSIONAL MODELS [MAGNETOTELLURISCHE MESSUNGEN IM RHEINGRABEN UND IHRE DEUTUNG MIT ZWEIDIMENSIONALEN MODELLEN]
Ingo Scheelke 1972 203 p refs In GERMAN
(GAMMA-20) Avail: NTIS HC $12.25

Magnetotelluric methods for determining the composition of inhomogeneous and anisotropic earth are discussed. Specific application of magnetotelluric methods for analyzing the geological composition of the Rhine River Valley is described. Mathematical models involving covariance functions, Fourier transformations, impedance tensors, and phase difference functions are presented. Results obtained from measurements conducted in various parts of the Rhine River Valley are included as tables and charts. Transl. by P.N.F.

N73-10389# Geological Survey, Washington, D.C.
A LAGRANGIAN METHOD FOR PREDICTING POLLUTANT DISPERSION IN BOLINAS LAGOON, MARIN COUNTY, CALIFORNIA
Hugo B. Fischer 1972 35 p refs
(USGS-582-B) Avail: SOD $0.65

A numerical method is described which is capable of predicting the movement and dispersion of a pollutant in a tidal embayment. The embayment may be segmented into a two-dimensional pattern, although flow within each segment is considered to be one dimensional. Each time increment includes a convective step, a diffusive step, and a concentration-decay step. The computer program will generate the motion and dispersion of a concentrated slug of pollutant, or it will predict the concentration of pollutant at all points within the embayment resulting from a constant discharge at one point. In a field experiment a slug of Rhodamine WT dye tracer dispersed in reasonable conformity to the numerical prediction. The method is used to predict the concentration distribution in Bolinas Lagoon resulting from a continuous addition of a pollutant at the location of the existing sewage outfall. A study is also made of the benefit resulting from detention of the pollutant during a 2-hour period at low tide. Author

N73-10390# Geological Survey, Washington, D.C.
GEOLOGICAL SURVEY RESEARCH 1972, CHAPTER B
1972 280 p refs
(USGS-PP-800-B) Avail: SOD $2.25

Scientific notes and summaries of investigations in geology and hydrology, and related techniques and analytical methods are presented. The specific areas of investigation include marine geology, paleontology and stratigraphy, glacial geology, economic geology, petrology and mineralogy, geochemistry, astrogeology, structural geology, isotope studies, urban hydrology, ground water, and surface water. N.E.N.

N73-10391# National Environmental Satellite Service, Washington, D.C.
THE MEASUREMENT OF ATMOSPHERIC TRANSMITTANCE FROM SUN AND SKY WITH AN INFRARED VERTICAL SOUNDER
W. L. Smith and H. B. Howell Sep. 1972 20 p refs

(NOAA-TR-NESS-61) Avail: SOD $0.30
Atmospheric transmittance is determined from ground based sun and sky radiance measurements with a prototype of the Nimbus E infrared temperature profile radiometer. The observations were obtained during November and December of 1971 from altitude 11,150 feet at the Mauna Loa Observatory, Hawaii. The measurements were conducted to check, and to correct as necessary, transmission models formulated from theoretical line-by-line calculations for application to the spacecraft ITPR measurements. Author

N73-10392*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SYNOPTIC STUDY OF THE NATURE AND EFFECTS OF FIELD ALIGNED LOW ENERGY ELECTRON PRECIPITATION IN THE AURORAL REGIONS Ph.D. Thesis - Catholic Univ. of America
Frederick W. Berko Oct. 1972 108 p refs
(NASA-TM-X-66065; X-646-72-384) Avail: NTIS HC $7.50 CSCL 04A

A synoptic study is presented of field-aligned precipitation events observed during a 16-month period, representing a full 4 pi precession of the satellite orbital plane in magnetic local time. The morphology of this type of precipitation, its nature, and relationships between this phenomenon and other geophysical events are discussed in the context of the 16-month data base. Author

N73-10393*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ELECTRON PRECIPITATION PATTERN AND SUBSTORM MORPHOLOGY
R. A. Hoffman and J. L. Burch Oct. 1972 49 p refs Submitted for publication
(NASA-TM-X-66063; X-646-72-370) Avail: NTIS HC $4.50 CSCL 04A

Patterns of the precipitation of low energy electrons observed by polar satellites were examined as functions of substorm phase. Precipitation boundaries are generally identifiable at the low latitude edge of polar cusp electron precipitation and at the poleward edge of precipitation in the premidnight sector. Both of these boundaries move equatorward when the interplanetary magnetic field turns southward. Author

N73-10394*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE RESPONSE OF THE UPPER ATMOSPHERE TO PERTURBATIONS FROM DIFFUSIVE EQUILIBRIUM
P. W. Blum Sep. 1972 20 p refs Submitted for publication
(NASA-TM-X-66057; X-621-72-357) Avail: NTIS HC $3.00 CSCL 04A

It is generally assumed that, in the atmosphere above 120 km, the deviations from diffusive equilibrium are small, though a minor constituent may show some deviation. The response of such a constituent to perturbations from diffusive equilibrium was analyzed qualitatively. It is shown that the magnitude of these deviations is mainly determined by the characteristic diffusion time. For a time-dependent perturbation, the ratio of the characteristic time of the perturbation to the characteristics diffusion time is an important parameter. Author

N73-10395*# Radio Corp. of America, Princeton, N.J. Astro-Electronics Div.
ATMOSPHERE EXPLORER MISSIONS C, D, AND E. SPACECRAFT EXPERIMENT INTERFACE DEFINITION STUDY Final Report, May - Nov. 1971
30 Mar. 1972 204 p
(Contract NAS5-11432)
(NASA-CR-130085; AED-R-3816F) Avail: NTIS HC $12.25 CSCL 04A

The Atmosphere Explorer Missions C, D, & E Spacecraft/Experiment Interface Definition Study is discussed. The objectives of the study included an analysis of the accommodation requirements of the experiments for the three missions, an assessment of the overall effect of these requirements on the spacecraft system design and performance, and the detailed definition of all experiment/spacecraft electrical, mechanical, and environmental interfaces. In addition, the study included the identification and definition of system characteristics required to ensure compatibility with the consolidated STADAN and MSFN communications networks. Author

N73-10396*# National Aeronautics and Space Administration, Washington, D.C.
PROBLEMS OF PHYSICS OF THE ATMOSPHERE, NO. 6 Table of Contents and Figure and Table Titles
K. Ya. Kondratyeva, ed. Jun. 1972 11 p Transl. into ENGLISH from "Problemy Fiziki Atmosfery, Sbornik 6" Leningrad, Leningrad Univ. Press, 1968
(NASA-TT-F-14424) Avail: NTIS HC $3.00 CSCL 04A

The titles, subtitles, and table of contents have been translated from the Soviet publication on the Problems of Physics of the Atmosphere. A.L.

N73-10397*# National Aeronautics and Space Administration, Washington, D.C.
THE INCLINED VISIBILITY RANGE AND THE BRILLIANCE OF DAYTIME SKY
K. S. Shifrin and N. P. Pyatovskaya Sep. 1972 42 p refs Transl. of Table of Contents, annotation and selected pages of a Russian book Leningrad, Hydrometeorol. Publishing House, 1959 p 1-19 and 126-134
(NASA-TT-F-14421) Avail: NTIS HC $4.25 CSCL 04A

Results of computations pertaining to the brilliance of atmospheric haze and to the daytime sky are presented. A great range of physical parameters was investigated that determine investigated values, which embrace concrete atmospheric conditions, and various types of terrestrial surfaces. The work is considered to be of value to scientific workers and engineers employed in the fields of geophysics, aerial surveying, illumination engineering and allied sciences. Tables are presented in a useful form. Author

N73-10398*# National Aeronautics and Space Administration, Washington, D.C.
THE POTASSIUM-ARGON AGE OF THE BOSUMTWI CRATER IN GHANA AND THE CHEMICAL COMPOSITION OF ITS GLASSES
W. Gentner, H. J. Lippolt, and O. Mueller Sep. 1972 14 p refs Transl. into ENGLISH from Max-Planck Inst. fuer Kernphys. (Heidelberg), v. 6, 1963 p 1-10
(NASA-TT-F-14496) Avail: NTIS HC $3.00 CSCL 08G

Two glasses from the Bosumtwi crater in Ghana which were collected during an excursion were dated by potassium argon measurements. The glass from the Buonim river shows an age of 1.2 + or - 0.1 x 1,000,000 y, which may be slightly lowered because of diffusion loss. The glass from the valley of the Ata river shows an age of 1.4 + or - 0.2 x 1,000,000 y. It possibly is somewhat increased by inherited argon. The average value for the age of the crater therefore is 1.3 + or - 0.3 x 1,000,000 y. This value is in good agreement with the potassium argon age of the Ivory Coast tektites (1.3 + or - 0.2 x 1,000,000 y, Zahringer 1962). By these experiments the common origin of Bosumtwi crater and the Ivory Coast tektites has been experimentally found for the first time. The chemical major and minor constituents of these two glasses and a tektite specimen from the Ivory Coast have been determined by X-ray-fluorescence technique and compared. Author

N73-10399*# Auburn Univ., Ala. School of Engineering.
ERISTAR: EARTH RESOURCES INFORMATION STORAGE, TRANSFORMATION, ANALYSIS, AND RETRIEVAL Final Report
Sep. 1972 436 p refs
(Grant NGT-01-003-044)
(NASA-CR-61392) Avail: NTIS HC $24.00 CSCL 05B

The National Aeronautics and Space Administration (NASA) and the American Society for Engineering Education (ASEE) have sponsored faculty fellowship programs in systems engineering design for the past several years. During the summer of 1972 four such programs were conducted by NASA, with Auburn University cooperating with Marshall Space Flight Center (MSFC). The subject for the Auburn-MSFC design group was ERISTAR, an acronym for Earth Resources Information Storage, Transformation, Analysis and Retrieval, which represents an earth resources information management network of state information centers

administered by the respective states and linked to federally administered regional centers and a national center. The considerations for serving the users and the considerations that must be given to processing data from a variety of sources are described. The combination of these elements into a national network is discussed and an implementation plan is proposed for a prototype state information center. The compatibility of the proposed plan with the Department of Interior plan, RALI, is indicated. Author

N73-10400*# Auburn Univ., Ala. School of Engineering.
ERISTAR: EARTH RESOURCES INFORMATION STORAGE, TRANSFORMATION, ANALYSIS, AND RETRIEVAL ADMINISTRATIVE REPORT NASA/ASEE Systems Design Summer Faculty Program
R. I. Vachon, J. Fred O'Brien, Jr., Russell E. Lueg, and J. E. Cox Sep. 1972 54 p Program held in Huntsville, Ala., 5 Jun. - 18 Aug. 1972
(Grant NGT-01-003-044)
(NASA-CR-61394) Avail: NTIS HC $4.75 CSCL 05B

The 1972 Systems Engineering program at Marshall Space Flight Center where 15 participants representing 15 U.S. universities, 1 NASA/MSFC employee, and another specially assigned faculty member, participated in an 11-week program is discussed. The Fellows became acquainted with the philosophy of systems engineering, and as a training exercise, used this approach to produce a conceptional design for an Earth Resources Information Storage, Transformation, Analysis, and Retrieval System. The program was conducted in three phases; approximately 3 weeks were devoted to seminars, tours, and other presentations to subject the participants to technical and other aspects of the information management problem. The second phase, 5 weeks in length, consisted of evaluating alternative solutions to problems, effecting initial trade-offs and performing preliminary design studies and analyses. The last 3 weeks were occupied with final trade-off sessions, final design analyses and preparation of a final report and oral presentation. Author

N73-10401# Institut Royal Meteorologique de Belgique, Brussels.
GEOPHYSICAL OBSERVATIONS Monthly Bulletin, Nov. 1971 [OBSERVATIONS GEOPHYSIQUES BULLETIN MENSUEL, NOVEMBRE 1971]
Nov. 1971 27 p In FRENCH and DUTCH
Avail: NTIS HC $3.50

Geophysical data obtained at Dourbes (Belgium) relating to geomagnetism, air radioactivity, ionospheric parameters, seismology, atmospheric electricity, and cosmic rays during November 1971 are presented. ESRO

N73-10402# Institut Royal Meteorologique de Belgique, Brussels.
IONOSPHERIC AND COSMIC RAY OBSERVATIONS Monthly Bulletin, Feb. 1972 [OBSERVATIONS IONOSPHERIQUES ET DU RAYONNEMENT COSMIQUE BULLETIN MENSUEL, FEVRIER 1972]
Feb. 1972 31 p In FRENCH and DUTCH
Avail: NTIS HC $3.75

Results of ionospheric and cosmic ray (neutron component) observations at Dourbes (Belgium) are tabulated for February 1972. ESRO

N73-10403# Groupe de Recherches Ionospheriques, Paris (France).
POLARIZATION TEST ON WAVES REFLECTED BY THE IONOSPHERE [ESSAI SUR LA POLARISATION DES ONDES REFLECHIES PAR L'IONOSPHERE]
A. Haubert, G. Doyen, M. Agogue, and J. P. Longuemard 10 Feb. 1972 62 p In FRENCH
(GRI/NT/84) Avail: NTIS HC $5.25

The history of theoretical and experimental work on the polarization of ionospheric reflected waves is reviewed. Different experimental devices used at Garchy are described, and preliminary results are presented. An analysis of polarization ellipses as a function of recorded fields is reported. The influence of reflection on the ground during reception is emphasized, and the use of magnetic sensors located near the ground is recommended.
Author (ESRO)

N73-10404# Kiruna Geophysical Observatory (Sweden).
EFFECTS OF VLF PROPAGATION DURING IONOSPHERIC SUBSTORMS
Johnny Svennesson Jun. 1972 33 p refs
(KGO-Preprint-72-303) Avail: NTIS HC $3.75

Substorm effects observed on numerous VLF signals propagating within or near the auroral zone are presented and discussed for three different ionospheric substorm events during 1969. A good correlation is found between observed VLF phase anomalies and the extent and intensity of the cosmic noise absorption region during the substorms for both daytime and nighttime propagation. The VLF phase advance due to the influx of substorm particles depends on the ionospheric activity before the onset of the event. Strong VLF phase anomalies are observed locally at sub-auroral latitudes outside the midnight sector during two of the three discussed events. It is assumed that local sources of high energy electrons are responsible for these anomalies. Author (ESRO)

N73-10405# Institut Royal Meteorologique de Belgique, Brussels.
GEOPHYSICAL OBSERVATIONS Monthly Bulletin, Dec. 1971 [OBSERVATIONS GEOPHYSIQUES BULLETIN MENSUEL, DECEMBRE 1971]
Dec. 1971 27 p In FRENCH and DUTCH
Avail: NTIS HC $3.50

Geophysical data obtained at Dourbes (Belgium) relating to geomagnetism, air radioactivity, ionospheric parameters, seismology, atmospheric electricity, and cosmic rays during December 1971 are presented. ESRO

N73-10406# World Meteorological Organization, Geneva (Switzerland).
COMPARATIVE SEA-SURFACE TEMPERATURE MEASUREMENTS
Richard W. James and Paul T. Fox 1972 31 p refs
(WMO-336; MSA-5) Avail: NTIS HC $3.75

Under the auspices of WMO an international program exists under which ships of different countries measure sea surface temperatures and report them to weather centers. Temperatures are measured by two methods: by sampling the near surface water with a bucket and measuring the temperature, or by measuring the temperature of water drawn into a condenser intake system. A program to collect comparative data was organized in order to reduce errors in temperature observations and review techniques and a special log form was distributed to ships selected to make the desired comparisons at a standard synoptic reporting time. On the basis of the statistical analysis it was concluded that a standard system for observing sea surface temperature cannot be established.
Author (ESRO)

N73-10407# SACLANT ASW Research Center, La Spezia (Italy).
ENERGY LOSS IN SURFACE WAVE SPECTRA DUE TO DATA WINDOWING
Melbourne G. Briscoe 1 May 1972 12 p refs
(AD-742845; SACLANTCEN-TM-177) Avail: NTIS CSCL 08/3

Windowing or tapering of surface-wave time-series is often performed prior to spectral analysis. The loss of variance due to the windowing is theoretically a factor of 8/3 (for cosine windows), but this factor may vary in practice due to the non-white nature of wave spectra. A numerical experiment on 101 wave spectra has shown that although 8/3 is a good correction factor in the mean, corrections on individual records may vary from less than 2 to almost 4.3. Since rarely in geophysical studies are sufficient records available to allow one to approach some theoretical value in the mean, i.e. 8/3, correction of individual records is recommended. Author (GRA)

N73-10408# Nova Univ., Fort Lauderdale, Fla.
SURFACE CURRENT MEASUREMENTS BY EXPENDABLE PROBES
Saul Broida and William S. Richardson Jun. 1972 11 p refs
(Contract DOT-CG-20859A)
(AD-743706) Avail: NTIS CSCL 08/3

A method is described for measuring the absolute surface current velocity which is the vectorial sum of the sea current and the local wind drift velocities. The method uses an expendable

probe which can be dropped from aircraft or launched from surface vessels. The accurate measurements obtained can be particularly useful in search and rescue operations as well as in pollution monitoring incidents. Author (GRA)

N73-10409# Visidyne, Inc., Woburn, Mass.
A HIGH ALTITUDE RADIANCE MODEL Final Report, 17 Mar. 1971 - 14 May 1972
Thomas C. Degges 14 May 1972 221 p refs
(Contract F19628-71-C-0156; ARPA Order 1366; AF Proj. 8692)
(AD-745319; VI-91; AFCRL-72-0273) Avail: NTIS CSCL 04/1

A physical model that includes experimental data on and theoretical estimates of excitation processes that lead to emission of infrared radiation has been implemented in a computer program that computes infrared radiances for an earth's limb viewing geometry. The nominal spectral region of this study lies between five and twenty-five micrometers and emphasis is placed on radiation originating at altitudes between 70 and 500 km. An earlier model for the transport of infrared radiation in molecular bands with Doppler line shape, accurate only for linear molecules, has been extended to bands of polyatomic molecules. A chemistry program which includes the effects of vertical transport by eddy mixing and molecular diffusion has been developed to make possible an estimate of diurnal variation in the abundances of infrared emitting species. Author (GRA)

N73-10410# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
ANNUAL AND SUBANNUAL EFFECTS OF EUV HEATING. VOLUME 1: HARMONIC ANALYSIS
Barbara K. Ching and Yam T. Chiu 14 Apr. 1972 39 p refs
(Contract F04701-71-C-0172)
(AD-745305; TR-0172(2260-10)-9-Vol-1; SAMSO-TR-72-116-Vol-1) Avail: NTIS CSCL 04/1

The authors compute the rate of solar extreme ultraviolet radiation (EUV) heating in the upper atmosphere by photo-dissociation and photo-ionization, taking care to include properly the effects of oblique incidence of solar flux, sphericity of the atmosphere and ellipticity of the earth's orbit. The time and latitudinal variations of the computed heat function are revealed by numerical Fourier analysis of the heat function into harmonics of the yearly cycle. It is shown that EUV absorption contains a latitude independent semi-annual component of heating with the proper phase to account for the semi-annual density variations. Further, the annual component of the heat function predicts the existence of summer polar density increases in the northern and southern hemispheres. Author (GRA)

N73-10411# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
ANNUAL AND SUBANNUAL EFFECTS OF EUV (EXTREME ULTRAVIOLET) HEATING. VOLUME 2: COMPARISON WITH DENSITY OBSERVATIONS
Barbara K. Ching and Y. T. Chiu 15 Apr. 1972 33 p refs
(Contract F01701-71-C-0172)
(AD-745309; TR-0172(2260-10)-9-Vol-2; SAMSO-TR-72-116-Vol-2) Avail: NTIS CSCL 04/1

By a detailed comparison of annual and sub-annual components of extreme ultraviolet (EUV) absorption heat input with those of the Jacchia models, the authors consider the importance of EUV heating in the annual and sub-annual variations of the upper atmosphere. When all the geometrical effects of EUV heat input have been taken into account, it is found that a remarkable correspondence exists between properties of each harmonic component of EUV heat input and Jacchia model temperature and densities. Equinoctial latitude independence of diurnal averaged annual and sub-annual components of heat input and density is proposed as a test of the significance of the EUV heat input. The Jacchia model is found to satisfy this test rigorously. Author (GRA)

N73-10412# Committee on Tidal Hydraulics (Army), Washington, D.C.
HISTORY OF THE CORPS OF ENGINEERS COMMITTEE ON TIDAL HYDRAULICS, JANUARY 1949 - JUNE 1971
John B. Luckett Jun. 1972 60 p refs
(AD-744784; TB-18) Avail: NTIS CSCL 08/8

The report relates the history of a scientific committee formed for the study of tidal hydraulics and describes its accomplishments for a period of over twenty-one years. GRA

N73-10413# Fleet Numerical Weather Central, Monterey, Calif.
AN OPERATIONAL UPPER AIR ANALYSIS USING THE VARIATIONAL METHOD
John M. Lewis May 1972 57 p refs
(AD-745354; TN-72-3) Avail: NTIS CSCL 04/2

An upper air objective analysis of wind and temperature has been developed for operational use at Fleet Numerical Weather Central. The primary feature of this analysis scheme is the vertical and horizontal extrapolation of information into the data-sparse regions from the data-rich surface and jet aircraft level. The extrapolation is based on Sasaki's recent extensions of the variational analysis method. The hydrostatic equation and horizontal momentum equations are used as dynamical constraints and these equations are combined to relate temperature and wind through a generalized thermal wind relationship. The governing analysis equations are elliptic and amenable to solution by the relaxation process. Vertical coupling of both wind and temperature is demonstrated through the detailed examination of a case study in the North Pacific. Author (GRA)

N73-10414# General Electric Co., Santa Barbara, Calif. DNA Information and Analysis Center.
REACTION RATE DATA, NUMBER 31
Arthur A. Feryok Nov. 1971 34 p refs
(Contract DASA01-70-C-0035)
(AD-745370) Avail: NTIS CSCL 07/4

The report presents summaries of recent progress reports and other informal information of current interest in the reaction rate field. The reports stress ionization and upper atmosphere processes. GRA

N73-10415# General Electric Co., Santa Barbara, Calif. DNA Information and Analysis Center.
REACTION TIME DATA, NUMBER 32
Arthur A. Feryok Jan. 1972 35 p refs
(Contract DASA01-70-C-0035)
(AD-745371) Avail: NTIS CSCL 07/4

The report presents summaries of recent progress reports and other informal information of current interest in the reaction rate field. The reports stress ionization and upper atmosphere processes. GRA

N73-10416# Bendix Corp., Southfield, Mich. Research Labs.
CONTINUOUS HIGH VELOCITY JET EXCAVATION, PHASE 1 Final Report, 30 Apr. 1971 - 31 May 1972
Ray F. Chadwick and Michael C. Kurko May 1972 96 p refs
(Contract BM-HO-210034; ARPA Order 1579)
(AD-744014; RLD-6241) Avail: NTIS CSCL 13/2

The objective of the program was to assess the feasibility of rapid excavation of hard rock by means of continuous fluid jets produced by pressures in the range of 20,000 to 80,000 pounds per square inch. A total of eight rock types were selected and appropriate quantities of test specimens were procured. Cutting test data was analyzed to determine optimum settings of jet parameters within experimental ranges that result in rapid and efficient excavation of rock. Power requirements and excavation rates were estimated for a theoretical continuous jet excavation system and compared with those of a conventional system. Author (GRA)

N73-10417# Caribbean Research Inst., St. Thomas (Virgin Islands).
INCIDENT AND REFLECTED SOLAR RADIATION IN A TROPICAL ENVIRONMENT Final Report, 1 Feb. 1970 - 31 Jan. 1972
John B. Adams, Jean D. Larsen, and Richard M. Bond 1 Feb. 1972 94 p refs
(Contract F19628-70-C-0014; AF Proj. 7628)
(AD-743931; AFCRL-72-0096) Avail: NTIS CSCL 08/6

Field measurements were made of incident and reflected radiation on the island of St. Croix, U.S. Virgin Islands (lat. 17 degrees 45 min. N). Climatic zones of St. Croix range from desert to tropical rain forest. Field measurements were

supplemented by laboratory data and by aerial photography. Spectral reflectance measurements were made of the major types of rocks, soils and vegetation. The main rock types are readily identified by their reflectance properties, whereas the soils are less distinctive. Trees and other plants are difficult to identify by optical properties alone. Enhanced irradiation is common at certain solar angles from orographically controlled cumulus streets and from the sea surface. Radiation under a tropical forest canopy assumes the spectral distribution of chlorophyll. Visible wavelengths are strongly attenuated and near-infrared radiation may be dominant. Author (GRA)

N73-10418# Aeronautical Chart and Information Center, St. Louis, Mo. Technical Translation Section.
ON THE INTERPOLATION OF DEFLECTIONS OF THE VERTICAL USING TRIGONOMETRIC LEVELING
P. A. Gaidaev May 1972 23 p Transl. into ENGLISH from Geodeziya i Kartografiya (USSR), no. 9, 1971 p 10-18
(AD-743986; ACIC-TC-1816) Avail: NTIS CSCL 08/5

The paper describes a method of adjusting heights by trigonometric leveling. On the basis of the presented experiment, it is assumed this method is effective in a mountainous area. Author (GRA)

N73-10419# Army Foreign Science and Technology Center, Charlottesville, Va.
EXPERIENCE IN USE OF GYROTHEODOLITES IN INSPECTION OF POINTS IN A GEODETIC NET
N. P. Astakhova 18 May 1972 9 p Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), no. 5, 1971 p 41-44
(AD-744684; FSTC-HT-23-1578-72) Avail: NTIS CSCL 08/5

The use of gyrotheodolites for azimuth determinations on orienting points is described. The basic virtues of gyroscopic orientation are speed and independence of determination of azimuths and the capability of carrying out work independently of weather conditions, time of year and day, and physico-geographic characteristics of the operating area. Author (GRA)

N73-10420# Naval Undersea Research and Development Center, San Diego, Calif.
TEMPERATURE FLUCTUATIONS AT FIXED POSITION SAN DIEGO BAY Research and Development Report, Apr. 1969 - Nov. 1970
Edward L. Smith Jul. 1972 34 p refs
(AD-744921; NUC-TP-298) Avail: NTIS CSCL 08/10

The purposes of the report were to investigate the thermal structure of San Diego Bay and to determine the mechanisms that significantly influence it. The results show the following. (1) There are oscillations in the thermal structure that are related to tidal forces with periods of 24.6, 12.3, 8.3, and 6.2 hr. (2) A two-layer system develops in the spring and remains until autumn. The surface layer responds in phase to the surface tides, and the bottom layer follows the phase of the surface tide in time from 0.5 to 1.5 hr. (3) Temperature inversions occur in the spring and autumn, at night, and only during the low-water phase of spring tides. (4) The bay has an annual temperature cycle: The maximum temperatures occur in July and August and the minimum in January and February. The annual temperature change for surface and bottom water is 17.4C. The vertical temperature gradient is maximum during the summer, about 0.5C/m. Author (GRA)

N73-10421# California Univ., Riverside. Dept. of Geography.
COASTAL STUDIES IN BAJA CALIFORNIA
John A. Minch, Virginia Coleman, Jack B. Bale, Harold F. Gilman, and Douglas B. McDonald Jun. 1972 112 p refs
(Contract N00014-69-A-0200-5003)
(AD-744310; TR-O-72-1; TR-O-72-5; TR-O-72-2; TR-O-72-3; TR-O-72-4) Avail: NTIS CSCL 08/6

In June, 1970 Rodman Snead made a field study of particular rock types in the San Felipe area of Baja California. Later that summer at a remote sensing institute at the University of California, Riverside, Douglas McDonald and Rodman Snead had an opportunity to study three different types of aerial photographs taken over the San Felipe region. The three types of photographs were medium altitude black and white vertical photographs, low altitude color infrared oblique photographs, and Apollo IX space photography. The purpose of this paper is to mention the landforms observed on the ground which can be easily viewed on these photographs and to discuss the advantages and disadvantages of using each of the three types. Author (GRA)

N73-10422# Lamont-Doherty Geological Observatory, Palisades, N.Y.
RESEARCH DIRECTED TOWARD THE USE OF LONG AND INTERMEDIATE PERIOD SEISMIC WAVES FOR THE IDENTIFICATION OF SEISMIC SOURCES Semiannual Technical Report
Tosimatu Matumoto Apr. 1972 15 p refs
(Contract F19628-71-C-0245; ARPA Order 1795; AF Proj. 1795)
(AD-743837; AFCRL-72-0254; SATR-1) Avail: NTIS CSCL 08/11

Seismological research supported by Air Force contract F19628-71-C-0245 at the Lamont-Doherty Geological Observatory is summarized for the period 1 July 1971 to 31 December 1971. During this period extensive analysis was done on the systematic regional variations in stresses. High stress earthquakes that usually exhibit anomalously large high-frequency content are the most likely ones to be confused with explosion signals. Higher stresses are expected to be accumulated in regions where new faults are being created in competent rocks. A possible temporal change of travel time is observed at some of the stations in western United States. Author (GRA)

N73-10423# Hawaii Inst. of Geophysics, Honolulu.
GEOLOGY OF THE ONTONG JAVA PLATEAU: CHARTS Ph. D. Thesis
Loren W. Kroenke May 1972 83 p
(Contracts Nonr-3748(05); N00014-70-A-0016-0001)
(AD-743900; HIG-72-5-Charts) Avail: NTIS CSCL 08/7

Contents: Bathymetric chart of the Ontong Java Plateau North of the Solomon Islands (2 sheets); Location of cruise tracks and data on the Ontong Java Plateau; Sedimentary isochron chart of the Ontong Java Plateau between the ocean floor and basaltic basement; Structure contour chart of the Ontong Java Plateau. GRA

N73-10424# Rhode Island Univ., Kingston. Dept. of Geology.
COASTAL GEOLOGY BIBLIOGRAPHY OF NEW ENGLAND: A PUNCH CARD SYSTEM Final Report
John J. Fisher May 1972 131 p refs
(Contract DACW72-70-C-0019)
(AD-744001) Avail: NTIS CSCL 08/7

The bibliography is a cross-referenced index of coastal geologic studies of the New England coastal region. A marginal punch card bibliographic system devised for this project is discussed, and operational advantages for such a system for coastal reference studies of this type are outlined. Similar coastal geologic bibliographies both regional and topical in nature, are also reviewed. 750 references for the New England States are cross-indexed as to location and the following coastal geologic subjects: beaches, marine biology, changes of sea level, coasts, coastal engineering geology, offshore coastal geology, ecology, eolian sands, geology of coastal areas, sedimentation and waves, currents and tides. Author (GRA)

N73-10425# Hawaii Inst. of Geophysics, Honolulu.
GEOLOGY OF THE ONTONG JAVA PLATEAU Ph.D. Thesis
Loren W. Kroenke May 1972 133 p refs
(Contracts Nonr-3748(05); N00014-70-A-0016-0001; NR Proj. 083-603)
(AD-743899; HIG-72-5) Avail: NTIS CSCL 08/7

A geologic investigation of the Ontong Java Plateau in the western equatorial Pacific north of the Solomon Islands, using continuous reflection profiles taken between 1966 and 1971, has been completed. Bathymetric, sedimentary isochron, and structure contour charts constructed for this region show the top of the Plateau to lie about 2 km below sea level and to be underlain by about 1 km of flat-lying Cenozoic sediment incised by large submarine valleys. Structural relationships along the margins of the Plateau are complex, with intense deformation, including folding and reverse faulting, occurring south of a large homoclinal crustal flexure along the southwestern margin. Author (GRA)

N73-10426# Puerto Rico Univ., Mayaguez. Water Resources Research Inst.
SUBMARINE SPRING EXPLORATIONS: NORTHWEST COAST OF PUERTO RICO Final Report
Donald J. Percious Nov. 1971 54 p refs
(PB-210754; UPRICO-WRRI-FR-71-29-1; W72-10896; OWRR-A-029-PR(1)) Avail: NTIS HC $3.00 CSCL 08H

In an attempt to delineate areas of ocean groundwater discharge along the northwestern coastal area of Puerto Rico, a series of aerial photographic missions and near-coastal conductivity traverses were made. It was also an objective of the photographic missions to establish that the use of small format (35 mm) photography, using Ektachrome Infrared and Ektachrome X film, is a fruitful approach to water resources investigations for small agencies. Three spring areas were found using a trailing specific conductivity probe from the Institute's 34 foot research vessel. Author (GRA)

N73-10427# Geological Survey, Washington, D.C.
ACOUSTIC REFLECTION PROFILES: TRANSATLANTIC CROSSING WEST
M. F. Kane 1972 64 p
(PB-209872; USGS-GD-72-007) Avail: NTIS $3.00 CSCL 08G

The report releases unedited subbottom acoustic reflection profiles of Leg 3 of an international cruise performed by the U.S. Geological Survey through funding of the National Science Foundation under a program designated the International Decade of Ocean Exploration. Approximately 5,700 km of acoustic reflection track line was run between Monrovia, Liberia, and the Lesser Antilles. The geological setting, preliminary results, and types of equipment used are described in a text of 5 pages; the profiles are reproduced on 7 folded pages; hourly location data are provided on a detailed trackline map. Author (GRA)

N73-10428# Naval Postgraduate School, Monterey, Calif.
AN INVESTIGATION OF LINEAR TRANSIENTS ASSOCIATED WITH A TIME DEPENDENT BOTTOM SPIRAL M.S. Thesis
Norman Thomas Camp Mar. 1972 93 p refs
(AD-745194) Avail: NTIS CSCL 08/3

Ekman's linear equations for time dependent flow (neglecting wind stress) are solved using a time dependent Green's function and the method suggested by Welander (1957). The solution represents the vertical velocity profile in terms of the local time history of the changes in sea surface elevation determined by the divergence of the flow in the vertically integrated continuity equation. A fully implicit finite-difference scheme is developed to represent a time dependent seiche oscillating across a shallow infinite channel. The transients associated with the formation of the bottom spiral are clearly represented by the model and the influence of friction and Coriolis are individually and collectively introduced. The model allows independent calculation of velocity, volume transport, sea surface elevation, bottom stress, and the total energy balance of the system. Author (GRA)

N73-10429# Naval Postgraduate School, Monterey, Calif.
STABILITY AND CONVERGENCE STUDIES ON A NUMERICAL MODEL OF THE ARCTIC OCEAN M.S. Thesis
Robert Cecil Willems Mar. 1972 56 p refs
(AD-745182) Avail: NTIS CSCL 08/3

Complete solutions to the equations of motion are possible using numerical schemes. The model developed by Galt (1972) was investigated for stability and convergence. A series of runs indicated that the scheme, the three level Adams-Bashforth method for the new value of vorticity and then the successive over-relaxation method for the stream function, was stable for transport not exceeding 100 Sverdrups and a time step of one-half pendulum day. Convergence was determined by comparisons, with known analytic solutions, of phase velocity of Rossby waves, and for the steady state conditions, patterns of the stream function and the vorticity. Improved accuracy of the model was attained by using a finer grid. Author (GRA)

N73-10430# California Univ., Berkeley. Hydraulic Engineering Lab.
A STUDY OF WATER WAVES GENERATED BY TECTONIC DISPLACEMENTS Ph.D. Thesis
William J. Garcia, Jr. May 1972 123 p refs
(Contract DACW72-67-C-0002)
(AD-745420; HEL-16-9) Avail: NTIS CSCL 08/3

The Eulerian incompressible hydrodynamic numerical modeling method was used to study tsunamis in the vicinity of their source. An example study was done using motion of the eastern end of the Mendocino Escarpment for the source. The resulting tsunami was observed for the first 200 seconds after generation. The initial single crest of the tsunami split into two crests moving in opposite directions. The waves were observed to be dispersive and additional crests had formed by the end of the observation period. Wave crest elevation, wave speed and water particle velocity were observed and analyzed. Author (GRA)

N73-10431# Naval Underwater Systems Center, Newport, R.I.
DISSIPATION OF KINETIC AND THERMAL ENERGY IN THE MIXED SURFACE LAYER OF THE OCEAN (THE BARBADOS OCEANOGRAPHIC AND METEOROLOGICAL EXPERIMENT)
Alan T. Massey 5 Jul. 1972 41 p refs
(AD-745343; NUSC-TR-4180) Avail: NTIS CSCL 08/10

Measurements were made of the average and fluctuating components of the horizontal longitudinal velocity component at depths of 9 and 17 meters and of the average and fluctuating components of the temperature at a depth of 17 meters. The measurements were made using ducted-impeller current meters and a quartz crystal thermometer probe mounted on a spar buoy which was tethered to the stern of the R/V GILLIS. Author (GRA)

N73-10432# Environmental Prediction Research Facility (Navy), Monterey, Calif.
A DESCRIPTION OF THE ENVIRONMENTAL PREDICTION RESEARCH FACILITY HYDRODYNAMICAL-NUMERICAL MODEL
T. Laevastu and K. Rabe Mar. 1972 51 p refs
(AD-745759; ENVPREDRSCHFAC-TP-3-72) Avail: NTIS CSCL 08/3

The primary purpose of the report is to provide an operational description of the single-layer Hydrodynamical-Numerical (H-N) model and its use for a variety of local oceanographic analyses and predictions. The report also documents the latest additions to the model such as diffusion and transport computations, and the treatment of open boundaries. Author (GRA)

N73-10433# Philco-Ford Corp., Blue Bell, Pa. Communications and Technical Services Div.
MONTANA LARGE APERTURE SEISMIC ARRAY Quarterly Technical Report, 1 Mar. - 31 May 1972
Robert E. Matkins 15 Jun. 1972 94 p refs
(Contract F33657-72-C-0390; ARPA Order 1620)
(AD-745753; TR-2056-72-21; QTR-2) Avail: NTIS CSCL 08/11

The technical activity associated with the operation, maintenance, and improvement of the Montana Large Aperture Seismic Array (LASA) during the period 1 March - 31 May 1972 is related in this report. The short-period (SP) and long-period (LP) seismograph sensitivity performance statistics are indicated. Performance data on the SP seismometer and the SP and LP seismic amplifiers are presented. A new method of seismograph calibration using pseudo-random binary sequences (PRBS) and the development of a PDP-7 program to provide an LP PRBS input to the LP seismograph are described. Removal dates for the array's microbarograph sensors are given. Statistics relating to the operation and maintenance of the array and data center equipment and land facilities support are provided. Author (GRA)

N73-10434# Geological Survey, Washington, D.C.
VISIBLE FLUORESCENCE OF EARTH SURFACE MATERIALS AND POTENTIAL APPLICATIONS IN REMOTE SENSING Final Report
George F. Stoertz 1972 62 p refs
(PB-210621; USGS-DO-72-010) Avail: NTIS HC $3.00 CSCL 08G

Fluorescence emission spectra of 368 samples analyzed by improved techniques demonstrate that a wide range of important materials on the earth's surface display appreciable fluorescence

when irradiated by rays present in the sun's spectrum. Spectrofluorometer analyses of samples from the Atacama Desert, from Iran, and from the Great Basin confirm that the floors of desert basins are commonly encrusted by minerals that emit moderately intense fluorescence. Although spectral differences among common surface materials may be small, they appear to be sufficient to serve as a basis for discriminating them by means of an advanced airborne fluorescence sensor such as a Fraunhofer line discriminator. Author (GRA)

N73-10435# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
POST DOCTORAL RESEARCH IN SEISMOLOGY Annual Report, 1 Jul. 1969 - 30 Jun. 1971
Frank Press, M. Nafi Toksoz, and Keiiti Aki 31 Dec. 1971 150 p refs
(Grant AF 49(638)-1763; ARPA Order 292-67; AF Proj. 8652)
(AD-746031; AFOSR-72-1324TR) Avail: NTIS CSCL 08/11

Research has been carried out on observations of surface and body waves from explosions and earthquakes and the structure and dynamics of the earth crust and upper mantle. Wave spectra have been studied using the Large Aperture Seismic Array (LASA) in Montana and the M.I.T. tiltmeter. Shear waves generated by large underground explosions have been used to estimate the magnitude of tectonic strain release accompanying explosions. Near-field observations are fitted by a gliding-edge dislocation model. Theoretical studies have been done using finite differences, complex frequency, and generalized ray theory. Author (GRA)

N73-10436# Emmanuel Coll., Boston, Mass.
HF BACKSCATTER STUDY AT 19.4 MHz THROUGH SUBAURORAL IONOSPHERE Interim Report
Sunanda Basu and Robert L. Vesprini May 1972 48 p refs
(Contract F19628-71-C-0250; AF Proj. 414L)
(AD-746311; AFCRL-72-0332; SR-2) Avail: NTIS CSCL 04/1

The aim of this study was to determine the effects of direct scatter from field aligned E- and F-layer irregularities, as well as scatter from intense E(s) clouds on the 19.4 MHz oblique backscatter signal propagating via the F-layer. Author (GRA)

N73-10437# Stanford Research Inst., Menlo Park, Calif.
EXCITATION AND DEEXCITATION OF VIBRATION IN GASES BY OXYGEN AND NITROGEN ATOMS Semiannual Technical Report, 27 Dec. 1971 - 27 Jun. 1972
Graham Black, Donald J. Eckstrom, and Robert L. Sharpless 12 Jul. 1972 27 p refs
(Contract DAHC04-72-C-0015; ARPA Order 1482; SRI Proj. PYU-1664)
(AD-745925; SATR-1) Avail: NTIS CSCL 04/1

In the E region of the earth's atmosphere, a number of exothermic chemical reactions occur that can produce N2*, vibrationally excited nitrogen. In the lower E region (below 125 km) the major loss of nitrogen vibrational energy is by energy transfer to CO2, with subsequent radiation in the infrared (principally at 4.3 micrometers). The report discusses two of the main processes that have been considered for producing N2*: N(quadruplet S) + NO yields N2 + O(triplet P) + 3.27 ev and O(singlet D) + N2 yields N2 + O(triplet P) + 1.96 ev. A second aspect of the atmospheric processes powering emissions through N2* concerns the reactions that can quench it in the upper atmosphere. The rate coefficients for the V-T energy exchange with O(triplet P) in the upper E region are not known for the temperatures found in the earth's atmosphere. A second goal has, therefore, been measurement of this rate for temperatures approaching 1200 K or lower, using a shock tube. GRA

N73-10438# Thiokol Chemical Corp., Ogden, Utah. Astro-Met Div.
EXPERIMENTAL EVALUATION OF METHODS FOR PRODUCING DENSE BARIUM ION CLOUDS Final Report
George Alford, Russell Reed, Jr., and V. Thomas Dinsdale Griffiss AFB, N. Y. RADC 15 May 1972 40 p refs
(Contract F30602-69-C-0030; ARPA Order 1225; ARPA Order 1057)
(AD-745980; RADC-TR-72-142) Avail: NTIS CSCL 04/1

A flight test program has demonstrated a new release technique for creating large and dense barium vapor clouds in the upper atmosphere. Payload Canuto of Operation Barbizon used a new thermite formulation consisting of barium metal reacting with barium nitrate to produce a barium vapor cloud which was larger and more dense than a vapor cloud produced by the same amount of standard thermite and released at the same altitude. Peak electron density was 46 percent greater for the new formulation. For the new thermite, barium and barium nitrate are mixed in the ratio of 12 moles of barium metal per mole of barium nitrate. The barium metal chips and barium nitrate powder are pressed into a porous cohesive grain contained in a combustion canister. This reaction is characterized by very rapid combustion, high combustion pressure, and reaction products containing only barium and barium oxide. Author (GRA)

N73-10439# California Inst. of Tech., Pasadena. Earthquake Engineering Research Lab.
STRONG MOTION EARTHQUAKE ACCELEROGRAMS. DIGITIZED AND PLOTTED DATA. VOLUME 1: UNCORRECTED ACCELEROGRAMS. PART D: ACCELEROGRAMS ID056 THROUGH ID070 ACCELEROGRAMS FROM THE SAN FERNANDO, CALIFORNIA, EARTHQUAKE OF FEBRUARY 9, 1971
Donald E. Hudson and A. Gerald Brady Nov. 1971 271 p refs
(Grant NSF GK-28098)
(PB-208529; EERL-71-21-Vol-1) Avail: NTIS HC $3.00 CSCL 08K

The first set of twenty uncorrected digitized earthquake accelerograms was published in July 1969 as Volume I, Part A, of the present series. That volume also contained introductory material and background information describing the methods used and accuracies, which should be referred to by all users of the data. The San Fernando Earthquake provided records of sufficient importance that the original plan was interrupted after two parts, and Part C contained the first of the San Fernando Earthquake accelerograms. This issue continues the San Fernando accelerograms and contains fifteen records consisting of three records each from four buildings, two ground level records at the Hollywood Storage Building and the record from the Old Ridge Route at Castaic. Author

N73-10440# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
RADAR METEOR WINDS AT EGLIN AFB, FLORIDA Environmental Research Papers
Arnold A. Barnes, Jr. 17 Mar. 1972 40 p refs
(AF Proj.8628)
(AD-745971; AFCRL-ERP-393; AFCRL-72-0186) Avail: NTIS CSCL 04/1

The Stanford University Mark II Radar Meteor Trail System was moved to Eglin AFB, Florida for field testing and to make comparison of winds obtained by the rocket, chemical release method and the radar meteor method. Recommendations for locating and maintaining meteor radar systems, as well as modifications for the Mark II system suggested by the aircraft and satellite calibrations and by operating experience, are given. Author (GRA)

N73-10441# Dartmouth Coll., Hanover, N.H. Radiophysics Lab.
TRAVELLING IONOSPHERIC DISTURBANCES Final Report, 1 Oct. 1967 - 30 Sep. 1971
Carlos H. J. Calderon and Millett G. Morgan 31 Oct. 1971 178 p refs
(Contract F19628-68-C-0099; AF Proj. 5631)
(AD-746314; AFCRL-72-0234) Avail: NTIS CSCL 04/1

A general study of travelling ionospheric disturbances (T. I. D.'s) has been undertaken. In the theoretical aspect, the gravity-wave resonant mode has been studied and the concept of an ionospheric predictive function has been introduced. In the experimental aspect the digital data processing portion of the Dartmouth ionosonde network has been brought into operation and seven T.I.D. events have been analyzed with it. The data have been interpreted in light of Hooke's theory and substantial agreement has been found. Author (GRA)

N73-10982* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A 3-D MULTILATERATION: A PRECISION GEODETIC

MEASUREMENT SYSTEM
P. R. Escobal, H. F. Fliegel, R. M. Jaffe, P. M. Muller, K. M. Ong, and O. H. VonRoos *In its* JPL Quart. Tech. Rev., Vol. 2, No. 3 Oct. 1972 p 1-11 ref (For availability see N73-10981 01-34)
CSCL 08E

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N73-10442 National Lending Library for Science and Technology, Boston Spa (England).
A METER FOR TEMPERATURE FLUCTUATIONS
V. A. Zajcev and A. A. Ledohovich [1972] 34 p refs Transl. into ENGLISH from Russian book
(NLL-M-20703-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

The development of a meter for measuring temperature fluctuations is discussed. The instrument is used to measure the temperature fluctuations in clouds and precipitation from an airborne platform. The circuitry of the thermohygrometer is described. The specifications of the components which comprised the instrument are analyzed. Various meteorological applications of the instrument are investigated. P.N.F.

N73-10443 National Lending Library for Science and Technology, Boston Spa (England).
THE APPLICATION OF ELECTRONIC MEASURING INSTRUMENTS FOR INVESTIGATING SNOW COVER
W. Dolinski et al [1972] 9 p refs Transl. into ENGLISH from Wiad. Sluzby Hydr. Met. (Poland), 1971 p 47-54 No diagrams etc.; to be used in conjunction with original book
(NLL-M-22676-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A radio isotope snow gage is described. The construction of the gage and its working principle are given. The results obtained by means of both radioisotope snow gage and snow weighing gage during the winter seasons of 1966/67 and 1967/68 at Hala Gasienicowa in the Tatra Mountains are given and discussed. Temperature measurements carried out by means of an electric temperature recorder at four different levels inside and two levels above the snow cover are also described. Good agreement between the changes in water content of a snow cover measured with an isotope instrument and the actual weather conditions can easily be obtained. Author

N73-10444*# Long Island Univ., Greenvale, N.Y. Science Engineering Research Group.
IN SITU SPECTRORADIOMETRIC QUANTIFICATION OF ERTS DATA Progress Report, period ending 15 Aug. 1972
Edward Yost, Principal Investigator 16 Aug. 1972 1 p
(Contract NAS5-21793)
(E72-10173; NASA-CR-128364) Avail: NTIS HC $3.00 CSCL 14B

There are no author-identified significant results in this report.

N73-10445*# Long Island Univ., Greenvale, N.Y. Science Engineering Research Group.
IN SITU SPECTRORADIOMETRIC QUANTIFICATION OF ERTS DATA Progress Report, period ending 15 Oct. 1972
Edward Yost, Principal Investigator 20 Oct. 1972 1 p
(Contract NAS5-21793)
(E72-10174; NASA-CR-128365) Avail: NTIS HC $3.00 CSCL 14E

There are no author-identified significant results in this report.

N73-10446# Physics Lab. RVO-TNO, The Hague (Netherlands).
A SPEED AND ACCELERATION MEASURING SYSTEM FOR MILITARY VEHICLES
A. W. M. VanDerVoort Jan. 1972 186 p In DUTCH; ENGLISH summary
(PH-L-1972-5; TDCK-60064) Avail: NTIS HC $11.50

An apparatus, developed to measure the velocity and the acceleration of military vehicles, contains a Doppler radar which is used to measure the movement of the vehicles as a function of time. A displacement of the vehicle over a half wave-length of the used radar frequency corresponds with a period of the received Doppler frequency. The apparatus can measure velocities and accelerations of vehicles riding on a road or terrain, or of amphibian vehicles moving through the water. Author

N73-10447# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
CAMAC: A MODULAR INSTRUMENTATION SYSTEM FOR DATA HANDLING: SPECIFICATION OF AMPLITUDE ANALOGUE SIGNALS
1972 11 p
(EUR-5100-e) Avail: NTIS HC $3.00

The Euratom report defines the essential features of the CAMAC system of instrumentation. This system is primarily for on-line use with digital controllers or computers. The document specifies amplitude analogue signals which are recommended for use by CAMAC compatible units, unless there are strong technical reasons to the contrary. Author

N73-10448# European Atomic Energy Community, Geel (Belgium).
CALIBRATION METHODS OF VACUUM TECHNIQUE
H. L. Eschbach 1972 36 p refs In GERMAN; ENGLISH summary
(EUR-4797-d) Avail: NTIS HC $4.00

The contribution gives a short introduction into the problems of precise (absolute) physical measurements; the special difficulties encountered in the absolute measurement of gas densities are discussed. The efforts to arrive at primary standards for all pressure regions are mentioned. Advantages and disadvantages of methods for calibrating secondary standards are considered. Author

N73-10449# European Atomic Energy Community, Petten (Netherlands).
ON THE MEASUREMENT OF STORED ENERGY AND SPECIFIC HEAT OF METALS AND ALLOYS USING A DIFFERENTIAL-SCANNING-CALORIMETER
E. Lang and G. VonBirgelen Aug. 1972 79 p refs In GERMAN; ENGLISH summary
(EUR-4802-d) Avail: NTIS HC $6.00

The characteristics of a differential scanning calorimeter and its feasibility for physical investigations of metals were examined. The calorimeter is a useful tool for studies of solid state reactions in metals and alloys where the energy is released, e.g. where stored energy, introduced by quenching, cold working, or irradiation, as well as energies involved in phase transformations, are of the order of 0.1 cal/g and more. It is possible to perform an analysis of the kinetics of such reactions using this apparatus. The methods of calibration, specific heat determination, quantitative evaluation of DSC diagrams, and the determination of activation energies are discussed. Results of calibration experiments and measurements of the specific heat of Cu, Cu-Au, and Au-Ag alloys are presented as well as recovery spectra of cold worked copper, alpha brass, and Cu-25Au alloys, investigations of phase transformations in the Vo sub x system, and some examples of activation energy determination. Author

N73-10450# Advisory Group for Aerospace Research and Development, Paris (France).
FLIGHT TEST INSTRUMENTATION
Sep. 1972 76 p refs Partly in ENGLISH and partly in FRENCH
(AGARD-LS-50) Avail: NTIS HC $6.00

The impact of technological developments on improvements in the operating characteristics of flight test data systems is outlined. Special efforts were made to provide the non-engineer an outline of data acquisition/processing systems and capabilities, a look at mathematical techniques for extracting data from recorded information, and illustrate how these developments have influenced the design of flight test programs. For individual titles, see N73-10451 through N73-10457.

N73-10451 Boeing Co., Seattle, Wash. Commercial Airplane Group.
FLIGHT TEST INSTRUMENTATION SYSTEMS OF THE 70'S
Alex J. Ferkovich *In* AGARD Flight Test Instrumentation Sep. 1972 11 p (For availability see N73-10450 01-14)

The projected equipment, techniques, and procedures used in research flight test instrumentation systems are outlined. The impact of new technology on complex aircraft systems is discussed. E.H.W.

N73-10452 Advisory Group for Aerospace Research and Development, Paris (France).
AIRBORNE DATA ACQUISITION AND PROCESSING SYSTEMS
Alain Klopfstein *In its* Flight Test Instrumentation Sep. 1972 12 p (For availability see N73-10450 01-14)

The evolution of the in-flight measurement system concept from the mere compatibility of instruments to overall airborne data handling and processing is considered as well as its impact on system structure. Illustrations are given of various types of equipment and systems and of their utilisation according to particular requirements. Author

N73-10453 Royal Aeronautical Society, London (England).
GROUND HANDLING TECHNIQUES AND SYSTEMS
J. M. L. Thomas *In* AGARD Flight Test Instrumentation Sep. 1972 4 p (For availability see N73-10450 01-14)

The processing of data from large civil aircraft, particularly data from the Concorde's digital recordings, is discussed. Data cover digital magnetic tape for quasi-static parameters, FM magnetic tape for dynamic parameters, and film and paper tape for take-off and landing measurements. E.H.W.

N73-10454 French Flight Test Center, Istres.
DYNAMIC DATA PROCESSING SYSTEMS
M. B. Pennacchioni *In* AGARD Flight Test Instrumentation Sep. 1972 18 p (For availability see N73-10450 01-14)

An analysis was made of the systems used to measure in-flight, take-off runs, or landing data. Data are given for system flexibility, ease of pre- and post- processing, ease of communication between user and machine, bulk of system, and cost of using the system. Consideration is also given to measuring range, sensitivity, and accuracy of the system. E.H.W.

N73-10455 Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
THE ANALYSIS OF STEADY STATE AND RANDOM FLIGHT DATA
E. J. Durbin *In* AGARD Flight Test Instrumentation Sep. 1972 3 p (For availability see N73-10450 01-14)

The functional dependence of test time of random and deterministic flight data analysis is investigated. The investigation covers test planning, instrumentation technology, and data analysis techniques. E.H.W.

N73-10456 Arizona State Univ., Tempe. Lab. for Measurement Systems Engineering.
A UNIFIED APPROACH TO HANDLING NOISE IN MEASURING SYSTEMS
Peter K. Stein *In* AGARD Flight Test Instrumentation Sep. 1972 11 p refs (For availability see N73-10450 01-14)

A small portion of the new unified approach to the engineering of measuring systems is presented. The presentation and examples are selected to show the application of this approach to the determination, suppression, and documentation of noise levels in flight test measuring systems in which the initial measuring is of analog nature. A systematic methodology is developed for the determination and documentation of noise levels on any given test set-up, at any time, before, during or after a test, and without specific knowledge of the environmental factors which cause these noise levels. A strong plea is made for the recognition of measurement systems engineering as a discipline in its own right, which can and must be incorporated into engineering curriculi. The unified approach is offered as a starting point towards this end. The need for additional concept-research in this field is identified and the hope is expressed that united efforts among various nations will result in the production of measurement-oriented or measurement-conscious engineers of all disciplines and at all levels. Author

N73-10457 Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
IMPACT OF NEW TECHNOLOGY AS ILLUSTRATED IN AN ADVANCED OPERATIONAL DATA SYSTEM
Josef Herrmann *In* AGARD Flight Test Instrumentation Sep. 1972 11 p (For availability see N73-10450 01-14)

The impact of new technology in flight test instrumentation equipment is given for a comprehensive and advanced airborne data acquisition system and ground data processing station. This advanced operational data system is used for flight testing of the high performance MRCA aircraft involving several aircraft prototypes for different tasks at different test sites. Author

N73-10458*# Airborne Instruments Lab., Melville, N.Y.
HIGH SENSITIVITY INFRARED 10.6 MICROMETER HETERODYNE RECEIVER DEVELOPMENT Final Design Report
Apr. 1972 147 p refs
(Contract NAS5-11665)
(NASA-CR-130091; AIL-8783-3) Avail: NTIS HC $9.50 CSCL 14B

The results are presented for a study on the design of an infrared 10.6-micrometer quantum-noise-limited optical receiver subsystem. Performance measurements of the HgCdTe photomixer preamplifier combination were carried out for photomixer temperatures up to 152 K and a photomixer frequency response of up to 420 MHz was obtained. Results of temperature and bias cycling of HgCdTe photomixers are reported. Design considerations for an operational 10.6 micrometer heterodyne receiver are presented. These consist of design data on required laser LO illumination, heat load levels for photomixer cooler, photomixer uniformity and the effects of photomixer impedance match on receiver sensitivity. Analysis and measurements of 10.6 micrometer heterodyne detection in an extrinsic photoconductive (p-type) HgCdTe photomixer are also presented. Author

N73-10459# National Bureau of Standards, Washington, D.C. Heat Div.
OPTICAL RADIATION MEASUREMENTS: PHOTOMETRIC INSTRUMENTATION AND RESEARCH, 1970 TO 1971
Edward F. Zalewski, A. Russell Schaefer, Kshitij Mohan, and Donald A. McSparron Sep. 1972 45 p refs
(NBS-TN-594-2) Avail: SOD $0.50 as C 13.46:594-2

Some of the basic instrumentation which was developed for use in photometry is described. The design and application of photodetector amplifiers, lamp power circuitry, and mechanical instrumentation are discussed. Three photometric experiments are described: the stability testing of some flux lamps and intensity lamps and the determination of the dependence of relative intensity on orientation. Author

N73-10460*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STAR TRACKING RETICLES PROCESS FOR THE PRODUCTION THEREOF Patent Application
Wade O. Smith and Albert R. Toft, inventors (to NASA) Filed 17 Apr. 1972 25 p
(NASA-Case-GSC-11188-3; US-Patent-Appl-SN-244566) Avail: NTIS HC $3.25 CSCL 14B

A method for production of reticles which are nonreflective and suitable for transmission in the visible and ultraviolet regions is described. The product is a quartz base coated with highly adherent layers of chromium, chromium-silver, and silver vacuum deposited through a mask, and then coated with an electrodeposit of copper from a copper sulfate solution followed by an electrodeposit of black chromium. The masks are produced by coating a beryllium-copper alloy substrate with a positive working photoresist, developing the photoresist to leave a positive mask, plating uncoated areas with gold, removing the photoresist, coating the substrate with a negative working photoresist, developing the negative working photoresist to expose the base metal of the pattern, and chemically etching the unplated side of the pattern to produce the mask. The mask produced is then used in the vacuum deposition. NASA

N73-10461*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
ELECTRIC FIELD MEASURING AND DISPLAY SYSTEM Patent Application
Ronald J. Wojtasinski and Donald D. Lovall, inventors (to NASA) Filed 13 Sep. 1972 12 p
(NASA-Case-KSC-10731-1; US-Patent-Appl-SN-288847) Avail: NTIS HC $3.00 CSCL 14B

An apparatus for monitoring the electric fields of cloud formations within a particular area is described. It utilizes capacitor plates that are alternately shielded from the clouds for generating an alternating signal corresponding to the intensity of the electric field of the clouds. A synchronizing signal is produced for controlling sampling of the alternating signal. Such samplings are fed through a filter and converted by an analoque to digital converter into digital form and subsequently fed to a transmitter for transmission to the control station for recording. NASA

N73-10462*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
AUTOMATIC LIGHTNING DETECTION AND PHOTOGRAPHIC SYSTEM Patent Application
Ronald J. Wojtasinski, Larry D. Holley, Jimmie L. Gray (Federal Elec. Corp.), and Robert B. Hoover, inventors (to NASA) (Technicolor, Inc.) Filed 27 Sep. 1972 12 p
(NASA-Case-KSC-10728-1; US-Patent-Appl-SN-292682) Avail: NTIS HC $3.00 CSCL 14E

A system is described for monitoring and recording lightning strokes within a predetermined area using a camera with an electrically operated shutter with means for advancing the film in the camera after activating the shutter. The system includes an antenna for sensing lightning strikes which generates a signal that is fed to an electronic circuit which generates signals for operating the shutter of the camera. Circuitry is provided for preventing activation of the shutter as the film in the camera is advanced. NASA

N73-10463*# Applied Scientific Research, Inc., Houston, Tex.
PHOTOGRAPHIC AND PHOTOMETRIC ENHANCEMENT OF LUNAR ORBITER PRODUCTS, PROJECTS A, B AND C
Sep. 1972 555 p
(Contract NAS9-10477)
(NASA-CR-128581) Avail: NTIS HC $29.75 CSCL 14E

A detailed discussion is presented of the framelet joining, photometric data improvement, and statistical error analysis. The Lunar Orbiter film handling system, readout system, and the digitization are described, along with the technique of joining adjacent framelets by a using a digital computer. Time and cost estimates are given. The problems and techniques involved in improving the digitized data are discussed. It was found that spectacular improvements are possible. Program documentations are included. N.E.N.

N73-10464*# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.
APOLLO LUNAR SURFACE EXPERIMENTS PACKAGE Monthly Progress Review
Aug. 1972 88 p
(Contract NAS9-5829)
(NASA-CR-128597; BSR-3428) Avail: NTIS HC $6.50 CSCL 14B

Progress in the ALSEP program is reported. Test results are presented for the following areas: Apollo 17 (array E), data subsystem, structural/thermal and crew engineering, and lunar experiments. F.O.S.

N73-10465# National Oceanographic Instrumentation Center, Washington, D.C.
MODEL 735 DISSOLVED OXYGEN ANALYZER, BECKMAN INSTRUMENTS, INCORPORATED, FULLERTON, CALIFORNIA 92634 Instrument Fact Sheet
Sep. 1972 11 p
(NOAA-IFS-73003) Avail: NTIS HC $3.00

The Beckman Model 735 dissolved oxygen analyzer is designed to continuously measure the concentration of dissolved oxygen in shallow fresh water. Dissolved oxygen concentration on a choice of scales (10 to 5 ppm,0 to 10 ppm and 0 to 20 ppm) can be read directly from a panel meter on the face of the instrument or in terms of current or voltage for external recorder operation. The instrument consists of a sensor that detects the partial pressure of oxygen present and a terminal unit that converts the resulting signal to a reading in parts per million by weight of dissolved oxygen in chloride-free water. The instrument may also be used to determine the dissolved oxygen content of aqueous solutions other than fresh water by applying certain corrections to the data. Author

N73-10466# National Oceanographic Instrumentation Center, Washington, D.C.
MODEL MINOS DOM DISSOLVED OXYGEN MONITOR BECKMAN INSTRUMENTS, INCORPORATED, FULLERTON, CALIFORNIA 92634 Instrument Fact Sheet
Sep. 1972 7 p
(NOAA-IFS-73004) Avail: NTIS HC $3.00

The Beckman Instruments MINOS DOM dissolved oxygen monitor is designed primarily for oceanographic research and is intended to measure dissolved oxygen in sea water to depths of 3000 meters. The instrument is composed of a stainless steel pressure casing which houses the dissolved oxygen sensor, a temperature-compensating thermistor, signal-conditioning amplifiers, a dc to dc converter, a pressure compensator, a voltage-controlled oscillator, and an fm power amplifier. The fm signal produced by the package is transmitted to the surface where it can be recorded. Accessory equipment includes a terminal unit which supplies power to the monitor and demodulates the fm signal to provide 0 to 10 and 0 to 100 millivolt signals to drive a strip-chart recorder; in addition, a 0 to 5 vdc output is provided for data logging. Author

N73-10467# National Oceanographic Instrumentation Center, Washington, D.C.
MODEL 1131 DISSOLVED OXYGEN ANALYZER, IONICS, INC. WATERTOWN, MASSACHUSETTS 02172 Instrument Fact Sheet
Sep. 1972 7 p
(NOAA-IFS-73005) Avail: NTIS HC $3.00

The Ionics Model 1131 Dissolved Oxygen Analyzer is designed to provide a continuous measurement of dissolved oxygen concentration in water systems for industrial applications. Dissolved oxygen content in parts per million and temperature in degrees C can be read from a panel meter on the face of the instrument or in terms of voltage for recorder operation. Temperature compensation is provided between 5 and 50 C; however, there is no compensation for salinity or pressure. Author

N73-10468# National Oceanographic Instrumentation Center, Washington, D.C.
HYDROLAB 2A PORTABLE WATER QUALITY ANALYZER, HYDROLAB CORPORATION, AUSTIN, TEXAS 78757 Instrument Fact Sheet
Sep. 1972 11 p
(NOOH-IFS-73006) Avail: NTIS HC $3.00

A general description, performance specifications, and results of performance tests are given for the water analyzer. Problems involving the replacement of the cable between the dissolved oxygen sensor and terminal unit and the pressure effects on the dissolved oxygen reading are described. N.E.N.

N73-10469*# Perkin-Elmer Corp., Pomona, Calif. Aerospace Div.
OPERATIONS AND MAINTENANCE MANUAL, ATMOSPHERIC CONTAMINANT SENSOR, REVISION B
Mar. 1972 86 p
(Contract NAS9-12066)
(NASA-CR-128603; SPO-30249) Avail: NTIS HC $6.50 CSCL 14B

The sensor is a mass spectrometer system which continuously monitors the atmospheric constituents of hydrogen, water vapor, nitrogen, oxygen, and carbon dioxide, and monitors the Freons on a demand sampling basis. The manual provides a system description, operational procedures, and maintenance and troubleshooting instructions. Circuit diagrams are included. N.E.N.

N73-10470*# Vought Missiles and Space Co., Dallas, Tex.
LABORATORY PROTOTYPE FLASH EVAPORATOR Final Report
J. L. Gaddis Oct. 1972 108 p ref
(Contract NAS9-12026)
(NASA-CR-128608; VMSC-T157-15; MSC-07098) Avail: NTIS HC $7.50 CSCL 14B

A laboratory prototype flash evaporator that is being developed as a candidate for the space shuttle environmental control system expendable heat sink is described. The single evaporator configuration uses water as an evaporant to accommodate reentry and on-orbit peak heat loads, and Freon 22 for terrestrial flight phases below 120,000 feet altitude. The design features, fabrication techniques used for the prototype unit, redundancy considerations, and the fluid temperature control arrangement are reported in detail. The results of an extensive test program to determine the evaporator operational characteristics under a wide variety of conditions are presented. Author

N73-10471*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
USE OF LEED, AUGER EMISSION SPECTROSCOPY AND FIELD ION MICROSCOPY IN MICROSTRUCTURAL STUDIES
John Ferrante, Donald H. Buckley, Stephen V. Pepper, and William A. Brainard 1972 65 p refs Presented at the Tools and Techniques for Microstruct. Anal. Conf., Chicago, 17-18 Sep., 1972; sponsored jointly by the Am. Soc. for Metals and the Intern. Microstruct. Anal. Soc.
(NASA-TM-X-68152; E-7103) Avail: NTIS HC $5.25 CSCL 14B

Surface research tools such as LEED, Auger emission spectroscopy analysis, and field ion microscopy are discussed. Examples of their use in studying adhesion, friction, wear, and lubrication presented. These tools have provided considerable insight into the basic nature of solid surface interactions. The transfer of metals from one surface to another at the atomic level has been observed and studied with each of these devices. The field ion microscope has been used to study polymer-metal interactions and Auger analysis to study the mechanism of polymer adhesion to metals. LEED and Auger analysis have identified surface segregation of alloying elements and indicated the influence of these elements in metallic adhesion. LEED and Auger analysis have assisted in adsorption studies in determining the structural arrangement and quantity of adsorbed species present in making an understanding of the influence of these species on adhesion possible. These devices are assisting in the furtherance of understanding of the fundamental mechanism involved in the adhesion, friction, wear, and lubrication processes. Author

N73-10472*# Bowles Fluidics Corp., Silver Spring, Md.
DEVELOPMENT OF A THREE AXIS FLUIDIC AIRSPEED SENSOR Final Report
Vincent F. Neradka Aug. 1972 47 p refs
(Contract NAS1-11266)
(NASA-CR-112167; R-08-15-72) Avail: NTIS HC $4.50 CSCL 14B

A three axis fluidic airspeed sensor system has been fabricated and wind tunnel tested. The complete system consists of the fluidic sensor, air power supply and instrumentation and readout. The system is adapted to aircraft and requires only the standard aircraft 28V dc supply to function. Author

N73-10473*# Translation Consultants, Ltd., Arlington, Va.
PRINCIPAL COMPONENTS OF THE CHARACTERISTICS CURVES FOR PHOTOGRAPHIC MATERIALS
V. V. Gavrik and I. M. Davydkin Washington NASA Nov. 1972 12 p refs Transl. into ENGLISH from Zh. Nauch. i Priklad. Fot. i Kinematografii (Moscow), v. 15, no. 5, Sep./Oct. 1970 p 353-359
(Contract NASw-2038)
(NASA-TT-F-13920) Avail: NTIS HC $3.00 CSCL 14E

The number and type of principal components required to describe the characteristic curves of the great variety of black and white photographic materials in use and processed under what are, for these materials, typical conditions are discussed. The effect reducing the variety has on the principal components is reviewed. Author

N73-10474# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Instrumentierung und Anthropotechnik.
ELECTRONIC AIRCRAFT DISPLAYS [ELEKTRONISCH ERZEUGTE INFORMATIONSDARSTELLUNG IN FLUGZEUGEN]
Ralf Beyer 1972 66 p refs In GERMAN; ENGLISH summary Sponsored by the Deut. Forschungsgemeinschaft
(DLR-FB-72-43) Avail: NTIS HC $5.50; DFVLR, Porz 15,50 DM

A survey of electronic cockpit displays is presented with particular emphasis on display requirements, technology, implementation, system integration, and assessment. The concepts of head-up, head-down and eyeglass displays are discussed in relation to human factors engineering. The technologies used in modern display devices, such as the CRT, shadow-mask tubes, chromatrons, color tubes with velocity modulated and intensity modulated beams, light-emitting diodes, electroluminescent readouts, laser readouts, liquid crystals, and plasma displays, are reviewed. The quality assessment is discussed based on instrument and pilot measurements. For further detailed evaluation it is necessary to use a display simulator. Author (ESRO)

N73-10475# Royal Aircraft Establishment, Farnborough (England).
EVALUATION OF THE ICE-WATER MIXTURE THERMOCOUPLE REFERENCE CHAMBER
G. R. Sutton Mar. 1972 19 p refs
(RAE-TR-72035; BR-28661) Avail: NTIS HC $3.00

The evaluation of an ice-water mixture thermocouple reference chamber is described. The effect of preparation and of increasing the thermal load at various immersion depths on the initial temperature and life time are considered. It has been shown that accuracies of 0.01 C can be achieved provided that the ice is made from distilled water, is shaved, thoroughly wetted and packed quite hard into the container. The re-entrant tube used to contain the thermocouples must be filled with a thermally conducting oil to just below the ice level and the depth of immersion must be sufficient for reasonable life times to be obtained. Author (ESRO)

N73-10476# Rome Univ. (Italy). Inst. of Physics.
A SUPERCONDUCTING STRAIN TRANSDUCER FOR GRAVITATIONAL RADIATION EXPERIMENTS
M. Cerdonio and G. Lucano 3 May 1972 13 p refs Sponsored by CNR
(Nota-Interna-373) Avail: NTIS HC $3.00

The feasibility of a strain transducer based on combined cryogenic techniques, to be used as strain detector in a liquid helium cooled gravitational wave antenna is discussed. The calculated sensitivity is significantly larger than that of Weber's antenna. In order to estimate the ultimate sensitivity, low temperature properties of ferromagnetic materials must be investigated as well as the operation of the sensitive element of a superconducting magnetometer in presence of such materials. Author (ESRO)

N73-10477# School of Aerospace Medicine, Brooks AFB, Tex.
THIN FILM WINDOW FOR GAS FLOW PROPORTIONAL DETECTOR Final Report, Feb. - Aug. 1970
Clarence F. Theis and Thomas D. Kay Jul. 1972 18 p refs
(AF Proj. 7758)
(AD-745579; SAM-TR-72-14) Avail: NTIS CSCL 18/4

The gas flow proportional detector used for counting radioisotopes incorporates a Micromii window which covers the open end of an ionization chamber. When it becomes contaminated or damaged, the window, with supporting metal ring, must be replaced with a new one at significant expense. A procedure was developed to reuse the rings in making new windows which are referred to here as gas flow ultrathin (GFUT) windows. The GFUT window has these advantages: it can be made in the laboratory from material that costs less than one cent per window; it is stronger than the commercial window; and it can be washed and reused. The time required to remove a damaged window, place a GFUT window on the same ring, and replace the window in the gas flow detectors is only 30 minutes. GFUT windows can be used satisfactorily in Nuclear-Chicago models D-47 and D-470 or similar systems. Author (GRA)

N73-10478# Brown Univ., Providence, R.I. Div. of Engineering.
NONADIABATIC EFFECTS IN CLOUD CHAMBER EXPANSIONS
Thor I. Eklund Jun. 1972 36 p refs
(Contract N00014-67-A-0191-0001; NR Proj. 082-241)
(AD-745348) Avail: NTIS CSCL 18/4

An energy balance was applied to the expansion process that occurs in a Wilson cloud chamber, and the nonadiabatic effects were thereby quantified. Chamber pressure, volume, and optical transmission were recorded continuously on a high-speed oscillograph, and this yielded highly accurate data both for chamber pressure against volume and for onset of condensation as a function of time. Both moist and dry argon were tested, and comparisons with theoretical values of heat transfer were made. Effective polytropic coefficients were defined, and the polytropic coefficients for the wet argon tests were used to calculate critical supersaturation. These actual critical supersaturations were compared with those computed for equivalent adiabatic expansions. The critical supersaturations were compared with the data of Wilson and Powell and also with the predictions from classical nucleation theory. Author (GRA)

N73-10479# TRW Systems Group, Redondo Beach, Calif.
DEVELOPMENT OF A ZERO-g GAUGING SYSTEM Special Technical Report, 11 Jan. 1971 - 25 Feb. 1972
Frank E. Bupp Mar. 1972 92 p refs
(Contract F04611-71-C-0010; AF Proj. 3058)
(AD-745566; AFRPL-TR-72-36) Avail: NTIS CSCL 18/4

The ultimate objective of this project is the development of a zero-g gauging system based on the absorption of gamma radiation. The numerous subsystem parameters of a nucleonic gauge were interrelated in closed form and subjected to appropriate tradeoff analyses and optimation routines to synthesize gauging systems capable of meeting the prescribed performance parameters. Particular emphasis was placed on achieving high levels of accuracy (1 percent or better over the entire range of full- to empty-tank conditions) with gauges configured completely external to spherical tanks fueled with cryogenic fuels. Nucleonic gauges capable of meeting the prescribed requirements were subjected to preliminary designs and critical subsystem elements were verified with laboratory testing. Author (GRA)

N73-10480# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHOD FOR TESTING DILATOMETERS ON SAMPLE SUBSTANCES TO GUARANTEE THE CONFORMITY OF DILATOMETRIC MEASUREMENTS IN THE USSR
P. G. Stelkov, I. I. Lifanov, and N. G. Sherstyukov 26 Apr. 1972 17 p refs Transl. into ENGLISH from "Metody Izmereniya Teplo-Rasshir Stekol Spaivaemykh Nimi Metal. TR. Vses. Simp. Dilatometrii" Leningrad, 1966 p 31-40
(AF Proj. 4900)
(AD-745840; FTD-HT-23-569-72) Avail: NTIS CSCL 14/2

As long ago as the early fifties one author suggested the possible use of quartz and corundum monocrystals as standard materials for dilatometer verification. Measurements were conducted on the Institute's relative quartz dilatometer operating in a temperature range of 20 - 900 degrees and on another such unit operating in the temperature range of -100 - -100 degrees. The measurements were performed on samples measuring from 2 to 20 mm in height and up to 10mm in diameter. The authors have plotted average curves for the specific elongation of the quartz and corundum monocrystals parallel and perpendicular to the optical axis. GRA

N73-10481# Army Air Mobility Research and Development Lab., Fort Eustis, Va.
THE DEVELOPMENT OF A PROBE FOR MEASURING THREE DIMENSIONAL BOUNDARY LAYERS Final Report
Michael R. Smith, Charles B. Cliett, and William W. Livingston May 1972 56 p refs
(Contract DAAJ02-67-C-0016)
(AD-745215; AASE-72-57; USAAMRDL-TR-72-18) Avail: NTIS CSCL 14/2

A remotely operated boundary layer probe designed for use in three-dimensional boundary layer measurements has been developed. The probe is an adaptation of a Cobra probe. The probe has been used to measure three-dimensional boundary layer flow over a yawed wing. Design procedures and final configurations are described. The experimental investigation indicates that the probe is adequate for measuring steady, three-dimensional boundary layer profiles. Author (GRA)

N73-10482# Clarkson Coll. of Technology, Potsdam, N.Y. Dept. of Physics.
SPARK CHAMBER SPECTROMETRY AND SPACE RADIATION STUDIES, 2 Final Report, 1 Dec. 1970 - 30 Nov. 1971
Richard Madey, Alan R. Baldwin, G. Thomas Huetter, and Stephen M. Yushak 31 Mar. 1972 94 p refs
(Contract F19628-71-C-0080; AF Proj. 8600)
(AD-741761; CPDD-72-1; AFCRL-72-0129) Avail: NTIS CSCL 04/1

Described in the report is a data acquisition system for a spark-chamber spectrometer, which consists of a unidirectional spark-chamber range telescope with differential pulse-height analysis of the specific energy loss of a charged particle that passes through the triggering telescope. Also described are the concept, design, construction, and performance of pulsed spark-discharge modules; The performance characteristics of a high-voltage pulse generator; a further study on the interpretation of previous measurements of the fluctuations in the energy loss of 66 and 100 MeV protons in a thin proportional counter; some representative experiments that would utilize spark chamber instrument systems for the measurement of charged particle spectra in and/or above the atmosphere; and the results of two studies on visual sensations induced in the dark-adapted eye by heavy cosmic-ray nuclei. Author (GRA)

N73-10483# Air Force Ballistic Missile Div., Patrick AFB, Fla.
DEVELOPMENT AND CALIBRATION OF MACH 1.5 SAND EROSION TEST APPARATUS Technical Report, Sep. 1966 - Apr. 1971
Dennis B. Pandy Mar. 1972 69 p refs
(AD-743309; AFAPL-TR-71-95) Avail: NTIS CSCL 14/2

Development of a Mach 1.5 Sand Erosion Test Apparatus is described. This rotating arm apparatus is designed to simulate the erosive environment which a turbine engine fan or compressor blade would see when operating with sand or dust ingestion. It will be used to evaluate the mechanisms of sand erosion and the relative erosion resistance of fan and compressor blade and coating materials at rotor tip speeds up to 1600 ft/sec. This report describes the design and development of the apparatus including the rotating arm, power train, test enclosure, and sand control system. Calibration and correlation experiments are also described. Author (GRA)

N73-10484# Tetra Tech, Inc., Pasadena, Calif.
THREE COLOR INFRARED RADIOMETER Final Report, 21 Jun. 1971 - 15 Feb. 1972
Marion Todd and Willard Wells Jul. 1972 27 p ref
(Contract N00014-72-C-0015; ARPA Order 1920)
(AD-745004) Avail: NTIS CSCL 08/10

A three-color infrared radiometer, intended primarily for examining the thermal radiance from the sea with maximum sensitivity for small temperature differences was designed. The radiometer operates in wavelength bands matched to the three most transparent atmospheric windows in the infrared, namely 2.3, 3.8, and 10 microns. Its thermal sensitivity in the two longer-wavelength bands equals the expected mean background thermal noise level. The radiometer was developed for an experiment to detect internal ocean waves through their radiometric effects. GRA

N73-10485# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN INVESTIGATION INTO THE CAUSES FOR THE SHORT LIFETIMES OF GEIGER-MULLER TUBES USED IN AIRCRAFT OIL GAUGING SYSTEMS M.S. Thesis
Dale E. Morin Jun. 1972 76 p refs
(AD-746267; GEP/PH/72-14) Avail: NTIS CSCL 18/4

The causes of failure of the G-M detectors used in the nucleonic oil gauging system of USAF aircraft are presented. Experimental tests performed on several tubes, in simulated aircraft environments, proved that the detectors fail because of a depletion of the halogen quench gas. A variety of surface analyses

established that the halogen gas reacted with both the cathode and anode surfaces. On the cathode the halogen (bromine) attack was always co-located with lead deposits and the only known source of lead inside the counter is from the glass solder used as the tube sealant. Recommendations are made to increase the G-M tube longevity. Implementing these recommendations rzquire only minor modifications to the basic system.

Author (GRA)

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

N73-10486 International Fluidics Services Ltd., Bedford (England).
INDUSTRIAL ROBOTS: A SURVEY, DETAILS OF CONSTRUCTION, PERFORMANCE, PRICES AND APPLICATIONS
Goeran Lundstroem, Lennart Lundstroem, Anders Arnstroem, and Brian Rooks, ed. 1972 178 p refs
Copyright. Avail: Issuing Activity

Data sheets for over 130 industrial robots manufactured in Japan, Europe, and the U.S.A., giving the manufacturers information on load capacity, positioning accuracy, power actuators, method of controls, occupied floor space, total weight, expected life, price range and manufacturers address are presented. Sketches showing working space, robot hand movements and general appearance are also included. Examples of applications and a list of questions to be asked before an installation is attempted are given. Trends of possible developments are mentioned and one chapter reports on the use of robots in automatic warehouses. Author

N73-10487 Engineering Sciences Data Unit, London (England).
EFFECT OF INCLINED NUT SEATINGS ON THE FATIGUE STRENGTH OF STEEL SCREW THREADS (TENTATIVE)
1 Jun. 1967 9 p refs Sponsored by Roy. Aeron. Soc.
(ESDU-67034) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

A method is given for estimating the effect of an inclined nut seating on the fatigue strength of a steel screw thread. The method is based on the calculation of an equivalent stress cycle which would produce the same endurance if the screw thread were loaded axially. The form of the relation between equivalent and nominal stresses is derived from a simplified elastic theory. Author

N73-10488 Engineering Sciences Data Unit, London (England).
DESIGN OF PARALLEL AXIS STRAIGHT SPUR AND HELICAL NONMETALLIC GEARS: CHOICE OF MATERIAL AND LOAD CAPACITY
Aug. 1971 20 p refs Sponsored by Inst. of Mech. Engr.
(ESDU-68001) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

Guidance is given on the choice of nonmetallic gear materials and a method of estimating the safe load that can be carried by nonmetallic spur and helical gears. The data given are for gears generated from the 20 deg flank rack forms. Two basic types of material are considered, synthetic resin bonded fabric and thermoplastics. The term fabric covers cotton fabrics and asbestos felt bonded with resin. Author

N73-10489 Engineering Sciences Data Unit, London (England).
GENERAL GUIDE TO THE CHOICE OF THRUST BEARING TYPE
1 Sep. 1967 7 p Sponsored by Inst. of Mech. Engr.
(ESDU-67033) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

A guide is presented for the early stages of design in the choice of the type of thrust bearing that is most likely to give required performance. It is emphasized that general guidance only is provided and in particular cases other considerations may effect the final choice. When the type of bearing has been chosen, other data items, or manufacturers' information where appropriate, must be used for the final design. Author

N73-10490 Engineering Sciences Data Unit, London (England).
INTRODUCTION TO THE DESIGN OF CAMS USING RADIAL FOLLOWERS
Aug. 1966 17 p Sponsored by Inst. of Mech. Engr.
(ESDU-66009) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

Methods for designing cams which use radial followers are discussed. Two types of followers are considered: (1) roller followers whose centers move on a straight line through the cam center of rotation and (2) flat faced followers with faces normal to the direction of motion. Specific information is provided concerning acceleration curves, angle-lift integral, jerk curves, and velocity curves. Mathematical models are developed to clarify the theoretical aspects. Author

N73-10491 Engineering Sciences Data Unit, London (England).
DRY RUBBING BEARINGS: A GUIDE TO DESIGN AND MATERIAL SELECTION BASED ON SPECIFIC APPLICATIONS
Mar. 1968 24 p refs Sponsored by Inst. Of. Mech. Engr.
(ESDU-68018) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

The design of dry rubbing bearings is discussed. Data are provided for choosing suitable bearing materials depending on the type of bearing. The advantages and limitations of dry bearings are analyzed. Tables and charts are included to provide concise information on physical and mechanical properties of dry rubbing bearings. Author

N73-10492 Engineering Sciences Data Unit, London (England).
CONTACT STRESSES BETWEEN CAM AND FOLLOWER
Jul. 1966 13 p refs Sponsored by Inst. of Mech. Engr.
(ESDU-66002) Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

Methods for determining the stresses between a cam and follower are presented. The calculated stresses are compared with allowable stresses determined by test or experience for the particular combination of materials, required life, lubrication conditions, surface finish, and sliding velocity of the cam and follower. Data for cam and follower combinations under pure rolling contact are discussed. The surface compressive stresses are given which led to failure by pitting in the specified number of hours. Author

N73-10493 Engineering Sciences Data Unit, London (England).
DESIGN OF PARALLEL AXIS SPUR AND HELICAL GEARS - GEOMETRIC DESIGN
Jan. 1966 13 p refs Sponsored by the Institution of Mech. Engr.
(ESDU-66001) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

The choice of suitable manufacturing dimensions is considered for parallel axis straight spur and helical gears generated from the B.S. 20 deg flank rack form. A design procedure is outlined and points which require futher explanation are dealt with. It should be noted that gear ratios higher than about 10 usually require multiple reduction gears for economic design. Author

N73-10494 Engineering Sciences Data Unit, London (England).
SINUSOIDAL ACCELERATION CAMS: CALCULATION METHODS FOR CAM
Jul. 1970 41 p refs Sponsored by Inst. of Mech. Engr.
(ESDU-66026-Amend-A) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

Numerical methods for determining the performance of sinusoidal acceleration cams as applied to cam profiles using

radial followers and no opening or closing ramps. Tables of data are presented for lift, velocity, acceleration, and jerk of various combinations of cam and followers. Mathematical models are presented to explain the characteristics of the flank interval and the nose interval. Author

N73-10495 Engineering Sciences Data Unit, London (England).
GENERAL GUIDE TO THE CHOICE OF JOURNAL BEARING TYPE
Nov. 1965 7 p Sponsored by the Institution of Mech. Engr.
(ESDU-65007) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

A guide is presented for the early stages of design in the choice of the type of journal bearing that is most likely to give the required performance. It is emphasized that general guidance only is provided and in particular cases other considerations may affect the final choice. When the type of bearing has been chosen, other items, or manufacturers' information where appropriate, must be used for the final design. Author

N73-10496 Engineering Sciences Data Unit, London (England).
SHAFTS WITH INTERFERENCE-FIT COLLARS. PART 1: SOME FACTORS AFFECTING THE DESIGN OF AN ASSEMBLY
1968 17 p refs Sponsored by the Institution of Mech. Engr.
(ESDU-68002) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

The main aspects of the design of interference-fit collars on rotating shafts are presented. The following design criteria are considered significant: (1) maximum stresses not to exceed specified allowable values for the materials chosen, (2) freedom from general slip under specified working conditions, and (3) a specified minimum fatigue strength. Expressions for forces in parallel shafts and the estimation of interface pressure are developed. Methods for improving fatigue performance are analyzed. Author

N73-10497 Engineering Sciences Data Unit, London (England).
SHAFTS WITH INTERFERENCE-FIT COLLARS. PART 2: NOMINAL ELASTIC INTERFACE PRESSURES AND STRESSES
Jan. 1970 15 p Sponsored by the Institution of Mech. Engr.
(ESDU-68003-Amend-A) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

Nominal interface pressures and stresses for shafts with interference fit collars are discussed. The data are obtained from plane stress elastic theory and apply to collars of constant thickness assembled with an axially uniform initial interference. The two dimensional theory on which the data are based is considered an accurate portrayal of stresses in the shaft and collar. Mathematical models are included to demonstrate the calculation procedures. Author

N73-10498# Central Electricity Generating Board, London (England). Information Services.
AUTOMATED NONDESTRUCTINVE TESTING: A SELECTIVE BIBLIOGRAPHY, 1963 - FEBRUARY 1972
P. G. Williams Aug. 1972 10 p refs
(CE-Bib-227) Avail: NTIS HC $3.00

A selective bibliography with abstracts is presented on nondestructive testing, geared mainly toward metallurgical processes and metallic structures. The emphasis is on ultrasonic, radiographic, and eddy current methods. There are 34 references. N.E.N.

N73-10499*# United Aircraft Corp., East Hartford, Conn.
BONDED JOINT AND METHOD Patent Application
John B. Sainsbury-Carter, inventor (to NASA) Filed 18 Sep. 1972 8 p
(Contract NAS1-10459)
(NASA-Case-LAR-10900-1; US-Patent-Appl-SN-290021) Avail: NTIS HC $3.00 CSCL 13H

The invention relates to the reduction of the peak shear stress which occurs in a bonded joint when an adhesive is used to bond two materials that have different moduli of elasticity or have discontinuous stiffness values. The use of a lower modulus insert provides a graduating effect between the two bonded materials and thereby reduces the discontinuity of stiffness which, in turn, reduces the peak shear stress in the adhesive bond. The novelty of the invention resides in the reduced peak shear stress achieved in adhesive bonds between materials with different moduli of elasticity, longer bond life, stronger bonds and prevention of bond delamination. NASA

N73-10500*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IMPROVED DIFFUSION WELDING Patent Application
Kenneth H. Holko, inventor (to NASA) Filed 29 Sep. 1972 12 p
(NASA-Case-LEW-11388-2; US-Patent-Appl-SN-293726) Avail: NTIS HC $3.00 CSCL 13H

Dispersion-strengthened alloys are sanded on one side and chemically polished. This is followed by a single-step welding process wherein the polished surfaces are forced into intimate contact at 1400 F for one hour in a vacuum. Diffusion, recrystallization, and grain growth across the original weld interface are obtained furing postheating at 2150 F for two hours in hydrogen. NASA

N73-10501*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FLOW CONTROL VALVE Patent Application
Lance G. Hays, inventor (to NASA) Filed 7 Sep. 1972 18 p
(Contract NAS7-100)
(NASA-Case-NPO-11951-1; US-Patent-Appl-SN-287150) Avail: NTIS HC $3.00 CSCL 13K

A flow control valve for high temperature fluids is described. The valve is characterized by an all-metal flow control unit including a tubular conduit terminating in a valve seat, a throttling cone having an internal, truncated conical surface coaxially related to the valve seat and supported for axial motion relative to the seat, and an axially reciprocable, flow control plug supported in coaxial relation with the cone. The plug is provided with a truncated conical surface to be mated with the surface of the throttling cone for regulating a flow of fluid established through the unit and a curved shutoff surface disposed at the distal end of the plug for engaging the valve seat whereby an interruption of the flow of fluid is achieved. NASA

N73-10502*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DUPLEX ALUMINIZED COATINGS Patent Application
Michael A. Gedwill and Salvatore J. Grisaffe, inventors (to NASA) Filed 16 Oct. 1972 12 p
(NASA-Case-LEW-11696-1; US-Patent-Appl-SN-298156) Avail: NTIS HC $3.00 CSCL 13H

The surface of a metallic base system is initially coated with a metallic alloy layer that is ductile and oxidation resistant. An aluminide coating is then applied to the metallic alloy layer. The chemistry of the metallic alloy layer is such that the oxidation resistance of the subsequently aluminized outermost layer is not seriously degraded. NASA

N73-10503*# Hercules, Inc., Magna, Utah. Composite Materials Development Dept.
DEVELOPMENT OF LIGHTWEIGHT GRAPHITE/POLYIMIDE SANDWICH PANELS, PHASES 3, 4 AND 5
J. B. Merlette Oct. 1972 113 p refs
(Contract NAS9-11368)
(NASA-CR-128610; H400-12-1-12) Avail: NTIS HC $7.75 CSCL 13H

Work performed in the last three phases of the program included: (1) face sheet processing; (2) honeycomb core manufacture; (3) face sheet-to-core bonding development; and (4) sandwich panel fabrication and testing. Resin cure studies were a major portion of this effort since processing problems traced to the polyimide matrix resin had to be resolved before quality core and face sheets could be fabricated. Honeycomb core fabrication and testing were conducted by Hexcel Corporation. A total of four graphite/polyimide resin composite cores were fabricated, tested, and reported. Two sandwich panels weighing .48 and .58 lb/sq ft, respectively were designed and fabricated which meet the support structure loads for the shuttle orbiter thermal protection system. Author

N73-10504*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GRINDING ARRANGEMENT FOR BALL NOSE MILLING CUTTERS Patent Application
Charles F. Burch, inventor (to NASA) Filed 14 Sep. 1972 19 p
(NASA-Case-LAR-10450-1; US-Patent-Appl-SN-289017) Avail: NTIS HC $3.00 CSCL 13I

An improved grinding arrangement is reported which enables high precision grinding of spiral fluted ball nose end mills and similar cutting tools. Provided is a cam follower and a specially contoured cam for automatically rotating the tool to be ground so as to maintain the tool at the same height on the grinding wheel during the grinding cycle. NASA

N73-10505*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GRAPHITE FIBER POLYIMIDE COMPOSITES FOR SPHERICAL BEARINGS TO 340 C (650 F)
Harold E. Sliney and Robert L. Johnson Washington Nov. 1972 19 p refs
(NASA-TN-D-7078; E-7063) Avail: NTIS HC $3.00 CSCL 13I

Journal bearings with self-alining spherical elements of graphite-fiber-reinforced-polyimide composites were tested from 24 to 340 C (75 to 650 F) at unit loads up to 3.5 times 10 to the 7th power N/sq m (5000 psi). The journal oscillated in the cylindrical bore of the composite element + or - 15 deg at 1 hertz. Outer races and journals were metal hardened of Rockwell C-32 and finished to 10 to the minus 7th power m. A 45 wt. percent graphite-fiber composite gave low friction (0.08 to 0.13), low wear, and almost no plastic deformation under any of the test conditions. Composites with 15 and 25 wt. percent graphite fiber failed by plastic deformation at 315 C (600 F) and 3.5 times 10 to the 7th power N/sq m (5000 psi). A composite with 60 wt. percent graphite fiber failed by brittle fracture under the same conditions, but had very low friction coefficients (0.05 to 0.10) and may be a good bearing material at lighter loads. Author

N73-10506*# California State Univ., Chico.
AN ANALYTICAL SOLUTION FOR THE SQUEEZE FILM BETWEEN A NONDEFORMABLE SPHERE AND GROOVE
Charles W. Allen and Michael P. Wilson Washington NASA Nov. 1972 15 p refs
(Contract NAS3-12426)
(NASA-CR-2139) Avail: NTIS HC $3.00 CSCL 11H

An analysis is presented to compute the film thickness, pressure and load relations between a rigid ball and rigid groove in normal approach when lubricated by a fluid with an exponential pressure-viscosity relationship. The geometry of the ball-groove system is reduced to the equivalent system of a paraboloid approaching a flat plate. Exact and approximate solutions are presented for the load and pressure relations. There is found to be a limiting load for a given geometry and lubricant regardless of the rate of approach. Author

N73-10507# Joint Publications Research Service, Arlington, Va.
DYNAMIC FRICTIONAL MOMENT OF THE BALL BEARING OF A PENDULUM SUSPENSION
A. D. Yegorov 16 Oct. 1972 7 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn, Zavedenii, Priborostr. (Leningrad), no. 7, 1972 p 94-97
(JPRS-57257) Avail: NTIS HC $3.00

Expressions for determining the friction in a ball bearing of a pendulum support are presented. The dynamic friction torque of the ball bearing and the arm of rolling friction at points of contact of the bearing with the inner and outer circles are discussed. Mathematical models are included to clarify the theoretical aspects. Author

N73-10508# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HIGH SPEED PULSED DEFORMATION AS A METHOD OF RELIEVING STRESSES AND ELIMINATING DEFORMATIONS
V. M. Sagalevich and G. F. Kondakov 8 Mar. 1972 13 p refs Transl. in ENGLISH from Tri. Mosk. Vysshee Tekhn. Uchilishche (Moscom), no. 133, 1969 p 105-110
(AF Proj. 6010)
(AD-745457; FTD-MT-24-1171-71) Avail: NTIS CSCL 13/5

Results are presented of investigations of a new method for eliminating plastic deformations and residual stresses by impact forming of the weld zone at high impact speed. Author (GRA)

N73-10509# Pennwalt Corp., King of Prussia, Pa. Research and Development Dept.
BASIC SOLID LUBRICANT STUDIES, 2 Final Report, 22 Feb. 1971 - 21 Feb. 1972
William H. Chappell May 1972 42 p refs
(Contract N00019-71-C-0322)
(AD-745001) Avail: NTIS CSCL 11/8

The objective of the work was to study the behavior of lubricant materials under some of the conditions encountered during lubrication, such as high pressure and temperature. A variety of solid lubricants was examined by microscopic, infrared spectrophotometric, and X-ray diffraction techniques in diamond high pressure cells at pressures up to 80 kbar and in some instances at temperatures up to 200 C. The compositions included binary sulfides of antimony, arsenic, molybdenum, and tungsten and other solid lubricants such as graphite, boron nitride, borax, mica, talc, vermiculite, and stearic acid. Also studied were complex sulfides including thioantimonates or thiomolybdates of arsenic, antimony, cadmium, cerium, copper, iron, molybdenum, silver, and tungsten and mixtures of sulfides with iron powder. Author (GRA)

N73-10510# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF FORGING CONDITIONS ON CORRELATION BETWEEN FORGING RATIO AND PLASTIC DEFORMATION
V. I. Popescu 22 Mar. 1972 16 p refs Transl. into ENGLISH from Metallurgia (Rumania), v. 23, no. 3, 1971 p 149-153
(AD-745432; FTD-HC-23-1789-71) Avail: NTIS CSCL 13/8

The influence of forging deformation degree upon mechanical properties of forged parts depends upon forging conditions, namely upon the ratio between elongation and spreading during forging. Because of this, the one and same forged steel, at identical forging deformation degrees but at different values for elongation and spreading intensity, presents also different mechanical properties. In order to avoid this drawback and to estimate properly the influence of forging deformation degree upon mechanical properties, the concepts of apparent forging deformation degree and of equivalent deformation degree are introduced and a new relationship for equivalent forging deformation degree estimation is discussed. Author (GRA)

N73-10511# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPEARANCE OF ELECTRIC FIELD DURING THE USE OF LUBRICATING OILS
G. I. Shor and V. P. Lapin 22 Mar. 1972 11 p refs Transl. into ENGLISH from the Mono. "Elektricheskie Yavleniya pri Trenii i Rezanii Metallov" Moscow, Nauka Publishing House, 1969 p 108-115
(AF Proj. 7343)
(AD-745433; FTD-HC-23-1842-71) Avail: NTIS CSCL 11/8

The scientific literature often contains data to the effect that lubricating oils of various types operate under conditions of an electric field. The appearance of an electric field is attributed to various causes, one of which is electrochemical emf. However, when rubbing parts separated by an oil film slide at high velocities, high electric potentials, caused by electrostatic charging of the lubricant during friction and deformation, can develop in addition to elestrochemical potentials. The electrostatic charging of heavy lubricants during their deformation in a rotation plastoviscometer was caused by the development of electrokinetic potentials due to the mutual displacement of the disperse phase (coagulant) and dispersion medium (oil). Electric charging of mineral oils and other hydrogen liquids during their friction on a metal surface takes place, as is shown in the report, despite the absence of a disperse phase. Author (GRA)

N73-10512# EF Industries, Inc., Louisville, Colo.
FORMING AND SHAPING OF TITANIUM ALLOY Final

Report
Lewis J. Effenberger Mass. Army Natick Labs. Sep. 1971 69 p
(Contract DAAG17-70-C-0099)
(AD-745113; USA-NLABS-TR-72-57-GP) Avail: NTIS CSCL 13/8

The purpose of the work was to develop and demonstrate a manufacturing process or combination of processes for forming 3/8-inch-thick titanium alloy plate into complex shapes. In order to achieve maximum ballistic protection from these parts, this process was to use a forming temperature as close to room temperature as possible. Room temperature explosive compression forming techniques were used in the fabrication of titanium plate geometries. Intermediate annealing was used to extend the degree to which the low formability titanium alloy could be plastically deformed prior to exceeding the limits of ductility.
Author (GRA)

N73-10513# Army Foreign Science and Technology Center, Charlottesville, Va.
PHENOMENOLOGICAL DESCRIPTION OF METAL DESTRUCTION EXPOSED TO SEVERAL TYPES OF AXIALLY SYMMETRIC DEFORMATION
O. G. Rybakina 14 Jun. 1972 11 p refs Transl. into ENGLISH from Mekh. Tverd. Tela (Moscow), no. 6, 1969
(AD-745551; FSTC-HT-23-1385-72) Avail: NTIS CSCL 11/6

The authors subjected metal (previously cold-worked by stretching) to a cyclic twisting. X-ray studies showed a qualitative improvement accompanied by loss of strength. Based on their findings, the authors propose a durability criterion for cyclic deformation.
Author (GRA)

N73-10514# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
A SINGULAR PERTURBATION METHOD OF CALCULATING THE BEHAVIOR OF SUPERCAVITATING HYDROFOILS WITH ROUNDED NOSES
Okitsugu Furuya Jun. 1972 117 p refs
(Contract N00014-67-A-0094-0021)
(AD-745791; E-79A.14) Avail: NTIS CSCL 13/10

A simple, direct and accurate method to predict the pressure distribution on supercavitating hydrofoils with rounded noses is presented. The thickness of body and cavity is assumed to be small. The method adopted in the present work is that of singular perturbation theory. Far from the leading edge, linearized free streamline theory is applied. Near the leading edge, however, where singularities of the linearized theory occur, a non-linear local solution is employed. The two unknown parameters which characterize this local solution are determined by a matching procedure. A uniformly valid solution is then constructed with the aid of the singular perturbation approach.
Author (GRA)

N73-10515# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INTEGRAL RELATIONSHIPS IN THE PLANAR PROBLEM OF GAS LUBRICATION AND SOME OF THEIR APPLICATIONS
A. I. Snopov 6 Apr. 1972 13 p refs Transl. into ENGLISH from Gazov. Smazka Podshipnikov (USSR), no. 9, 1968 p 71-78
(AF Proj. 734321)
(AD-745833; FTD-HC-23-117-72) Avail: NTIS CSCL 11/8

On the basis of equations analogous to Prandtl equations in the boundary layer theory, integral correlations valid under arbitrary movements of the journal and bearing centers are derived in a compact form, expressing the laws of mass variation, momentum, and energy in a two-dimensional layer of unit length of an isothermic lubricant. As an example of the application of the correlations the case of the steady-state motion of the lubricant is discussed, and a system of ordinary differential equations valid at any Reynolds number is set up for determining the pressure in the layer and the friction forces on the journal and the bearing. The approximate solution of these nonlinear equations is presented.
Author (GRA)

N73-10516# Naval Ship Research and Development Center, Annapolis, Md.
THERMOGRAPHIC TECHNIQUES FOR INSPECTION OF BABBITTED BEARINGS
Joe Dickey and Nicholas Brescia, Jr. Jul. 1972 39 p
(AD-745730; NSRDC-28-124) Avail: NTIS CSCL 13/9

The report describes the investigation of several thermographic (infrared) techniques and their applicability to the detection of unbonded areas in babbitted bearings. Standard defect samples were prepared with films of oil and grease between layers of babbitt and steel. These samples were systematically investigated by techniques designed to (1) detect a thermal shadow in an arrangment providing an equilibrium heat flux through the sample, or (2) detect differences in the time required for different areas of the sample to dissipate an impulse of heat. The results indicate that several techniques are capable of detecting unbonded areas and that a technique of measuring the return of the sample surface to equilibrium temperature following a thermal impulse was most sensitive to the sample defects. A design was developed to improve the technique. Some ultrasonic test results and some time-averaged interference holograms are also presented.
Author (GRA)

N73-10517# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOME METHODS OF INCREASING THE STABILITY OF ROTORS WITH GAS BEARINGS
G. I. Voronin and A. N. Bragin 6 Apr. 1972 18 p refs Transl. into ENGLISH from Gazov. Smazka Podshipnikov (USSR), no. 9, 1968 p 155-169
(AF Proj. 7343)
(AD-745858; FTD-HC-23-120-72) Avail: NTIS CSCL 13/9

On the basis of performed investigations and an analysis of the published data, the following areas of application of gas bearings are recommended: circular bearings can be used in small heat-stressed machines with a reserve of compressed gas and peripheral speeds on the bearing journal of not more than 80 m/sec; bearings with differential pressurization and multicentric bearings can be used in low-power heat-stabilized machines with decreased pressurization pressures and peripheral speeds on the bearing journal of not more than 90 m/sec; bearings with self-adjusting bushings can be used in medium- and high-power heat-stressed machines at peripheral speeds on the bearing journal up to 80 m/sec.
Author (GRA)

N73-10518# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THEORY OF A RADIAL GAS BEARING WITH CIRCULAR SUPPLY GROOVES
A. I. Snopov 6 Apr. 1972 13 p refs Transl. into ENGLISH from Gazovaya Smazka Podshipnikov (USSR), no. 9, 1968 p 63-70
(AD-745827; FTD-HC-23-118-72) Avail: NTIS CSCL 13/9

It is known that a substantial increase in the load capacity of a self-generating gas bearing can be obtained at a corresponding increase in the gas pressure on the bearing ends only. This can be realized structurally by blowing the gas into the bearing trough through two annular grooves in the bushing, by locating the grooves near by the ends, and by maintaining a constant and equal gas pressure in them. In this case, the middle section of the bearing, inclosed between the grooves, will act as a self-generating bearing, and the end sections will operate under conditions of an axial pressure drop.
Author (GRA)

N73-10519# Kaman Aerospace Corp., Bloomfield, Conn.
BOSSLER COUPLING EXPERIMENTAL FLIGHT TEST Final Report, 1 Jul. 1970 - 15 Feb. 1972
Robert B. Bossler, Jr. Mar. 1972 40 p refs
(Contract N00156-69-C-1316)
(AD-746502; R-981) Avail: NTIS CSCL 13/5

The Bossler coupling is a new flexible driveshaft coupling requiring experimental research to provide guidance for future design. Reported herein are bench tests of rotating driveshaft assemblies using Bossler couplings under combined speed, torque and misalignment, followed by an experimental flight test program in an HH-2D helicopter. The test driveshaft was designed to meet or exceed the capabilities of the existing main driveshaft on the Navy/Kaman HH-2D helicopter. Ten different couplings on two different driveshaft assemblies were bench tested under combined speed, torque and misalignment.
Author (GRA)

N73-10520# Midwest Research Inst., Kansas City, Mo.
PERFORMANCE OF BALLBEARINGS IN AIR AND VACUUM WITH NO ADDED LUBRICATION Technical Report, 1 Jan. 1969 - 8 Dec. 1971
Karl R. Mecklenburg Jun. 1972 43 p refs
(Contract F33615-69-C-1236)
(AD-746034; AFML-TR-72-73) Avail: NTIS CSCL 13/9

Forty-one experiments on six different designs of size 204 ball bearings were conducted. The results of these experiments, operating time and frictional torque values determined by coast-down times, are presented for various test atmospheres, loads, and speeds. The experimental approach is outlined and the different test apparatus are described. The distinctive design features of the production-type ball bearings are identified. Even though no lubrication was applied to any of these bearings, several of the specimens ran satisfactorily for over 10,000 hr at speeds of 1,790 and 3,600 rpm with light axial loads of 7 lb nominal. One specimen continues to operate in a vacuum environment axter 45,600 hr at 1,790 rpm. Author (GRA)

N73-10521# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
MULTI-WAFER PLASMA ANODIZATION M.S. Thesis
William B. Orcutt Jun. 1972 71 p refs
(AD-746003; GGC/EE/72-12) Avail: NTIS CSCL 13/8

A prototype multi-wafer plasma anodization apparatus was designed and constructed to investigate the multi-wafer process. The apparatus uses a hot hollow cathode to generate a dense discharge capable of yielding high oxide growth rates. The samples are placed parallel to the axis of the discharge in order to study the effects on oxide growth and quality of sample position with respect to discharge regions. Plasma and anodization parameters were varied to study the effect on oxide growth rates. The quality of the tantalum oxide samples was determined by visual and microscopic inspection of surfaces and by plotting capacitance and dissipation factor profiles. Results indicate that the multi-wafer process is feasible and that samples should be placed in the positive column of the discharge near the anode.
Author (GRA)

N73-10522# Defence Research Information Centre, Orpington (England).
THE INFLUENCE OF SURFACE ACTIVE SUBSTANCES ON CONTACT FATIGUE LIFE OF HARDENED BALL-BEARING STEEL
G. V. Karpenko, K. B. Katson, and A. B. Kuslitski Jul. 1972 6 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Uka. SSR (Kiev), no. 11, 1969 p 1042-1044
(AD-746040; DRIC-TRANS-2358; BR30221) Avail: NTIS CSCL 13/9

The fatigue life of impure steel ball bearings in the presence of surface active substances is described. GRA

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

N73-10523*# Rensselaer Polytechnic Inst., Troy, N.Y. School of Engineering.
LASER RANGE MEASUREMENT FOR A SATELLITE NAVIGATION SCHEME AND MID-RANGE PATH SELECTION AND OBSTACLE AVOIDANCE M.S. Thesis
Gerald D. Zuraski Jun. 1972 46 p refs
(Grant NGL-33-018-091)
(NASA-CR-128398; RPI-TR-MP-26) Avail: NTIS HC $4.50 CSCL 20E

The functions of a laser rangefinder on board an autonomous Martian roving vehicle are discussed. The functions are: (1) navigation by means of a passive satellite and (2) mid-range path selection and obstacle avoidance. The feasibility of using a laser to make the necessary range measurements is explored and a preliminary design is presented. The two uses of the rangefinder dictate widely different operating parameters making it impossible to use the same system for both functions.
Author

N73-10524# Defence Research Establishment Valcartier (Quebec).
CO2 LASER INDUCED BREAKDOWN AND DAMAGE TO SURFACES OF LASER OPTICAL MATERIALS
K. Kembry and R. W. MacPherson Jul. 1972 22 p refs
(DREV Proj. 95-10-106)
(DREV-TN-2013/72) Avail: NTIS HC $3.25

Thresholds for damage to the surfaces of infrared laser optical materials by intense 0.5 microsec pulses of CO2 laser radiation was measured. Very tentative values obtained for NaCl window material ranged from a low of MW/sq cm for coated surfaces to a high of 30 MW/sq cm for uncoated cleaved surfaces. The experimental difficulties encountered are discussed with a view to obtaining improved data in future, more extensive experiments.
Author

N73-10525# Defence Research Establishment Valcartier (Quebec).
CS2/O2 CHEMICAL LASERS: CHEMISTRY AND PERFORMANCE CHARACTERISTICS
R. D. Suart, P. Dawson, and G. H. Kimbell Aug. 1972 32 p refs
(DREV Proj. 95-10-68)
(DREV-R-656/72) Avail: NTIS HC $3.75

Experimental results from the carbon disulfide/oxygen chemical laser system using both a flash photolysis initiated pulsed laser and a microwave discharge initiated continuous wave laser were examined by computer simulation techniques. The comparisons between predicted and observed laser performance and the resulting conclusions concerning the chemical mechanisms operative in the laser are discussed. It was determined that the continuous wave laser operates on totally vibrational level populations when cold carbon monoxide is added to the reaction mixture.
Author

N73-10526*# General Electric Co., Philadelphia, Pa. Environmental Sciences Lab.
STUDY OF FLUID MECHANICAL HELIUM ARGON ION LASER
Apr. 1972 50 p refs
(Contract NASw-1728)
(NASA-CR-128397) Avail: NTIS HC $4.50 CSCL 20E

An approach to an argon ion laser based on gasdynamic techniques is presented. Improvement in efficiency and power output are achieved by eliminating high heat rejection problems and plasma confinement of the seal-off conventional lasers. The process of producing population inversion between the same energy levels, as in the conventional argon ion laser, has been divided into two phases by separating each other from the processes of ionization and subsequent excitation. Line drawings and graphs are included to amplify the theoretical presentation.
Author

N73-10527# European Space Research Inst., Frascati (Italy).
FREQUENCY SHIFT IN A MODE-SELECTED DYE LASER
G. Magyar 1972 10 p refs Submitted for publication
Avail: NTIS HC $3.00

It is found that a flash-lamp pumped dye laser with two tilted Fabry-Perot interferometer wavelength selectors shows frequency shift, both with dielectric or resonant reflector mirrors. The shift can be towards red or blue, even within one pulse, limited by the passband of the system. The wavelength-time effect and inhomogeneous pumping are indicated as possible mechanisms.
Author (ESRO)

N73-10528# Northrop Corp., Hawthorne, Calif. Laser Systems Dept.
CO2 LASER PULSING TECHNIQUES Final Report, Dec. 1969 - Feb. 1972
D. B. Cohn, R. G. Eguchi, W. B. Lacina, W. H. Steier, and M. M. Mann Apr. 1972 63 p refs
(Contract N00014-70-C-0185; ARPA Order 306)
(AD-744996; NLSD-72-9R) Avail: NTIS CSCL 20/5

Stable mode-locking and pulse coupling of a longitudinal discharge CO2 laser, using a single electrooptic element, was demonstrated successfully. The experimental results and data on the effect of modulator detuning and coupling factor variations are presented. Similar experiments were performed with a CO2

TEA laser in which loss-locking was obtained using the internal electrooptic element as an AM modulator. However, attempts at phase-locking were unsuccessful. Results of a detailed investigation of the discharge properties of the TEA laser are presented. The processes involved in mode-locking and their bearing on the observed results are discussed. Author (GRA)

N73-10529# Smithsonian Astrophysical Observatory, Cambridge, Mass.
LASER PREDICTIONS OF GEOS-1 AND GEOS 2 Final Report, 1 Dec. 1970 - 30 Nov. 1971
R. W. Martin Dec. 1971 6 p
(Contract F19628-71-C-0088; AF Proj. 7600)
(AD-745455; AFCRL-71-0611) Avail: NTIS CSCL 17/8

The report documents the work performed by the Smithsonian Astrophysical Observatory in supplying laser predictions for the Air Force Cambridge Research Laboratories. An average of 3500 predictions per week was generated for satellites GEOS 1 and GEOS 2 for a site at L. G. Hanscom Field, Bedford, Mass. Frequency of prediction was every 10 sec for every available pass over the station. Author (GRA)

N73-10530# Naval Research Lab., Washington, D.C.
HIGH ENERGY LASER WINDOWS Semiannual Report, Jan. - Jun. 1972
30 Jun. 1972 50 p refs
(ARPA Order 2031)
(AD-744998; SAR-1) Avail: NTIS CSCL 20/5

The report describes work done to develop and alkali halide window with suitable characteristics for laser uses. Alkali halides have a number of attractive properties that recommend them for windows for infrared lasers. A goal of this program is to improve the mechanical properties of the alkali halides by developing polycrystalline materials without destroying their excellent optical properties. The technique of press forging has been used Progress has been made in developing chemical polishing techniques as a final step after mechanical polishing to insure a smooth surface. A theoretical study of the source of optical absorption has been made for alkali halides at frequencies far higher than the Restrahl frequencies. GRA

N73-10531# Aerospace Corp., El Segundo, Calif. Lab. Operations.
COMPUTER MODELING AND PARAMETRIC STUDY FOR A PULSED H2 PLUS F2 LASER Technical Report, Dec. 1970 - Jun. 1971
Ronald L. Kerber, George Emanuel, and James S. Whittier 6 Jun. 1972 53 p refs
(Contract F04701-71-c-0172)
(AD-745425; TR-0172(2573)-3; SAMSO-TR-72-140) Avail: NTIS CSCL 20/5

A computer simulation of a pulsed HF laser pumped by the H2 - F2 chain reaction is presented. A chemical kinetic model encompassing 68 reactions is used to approximate the reacting mixture contained within an optical cavity. For each vibrational level, a Boltzmann distribution for the rotational levels is assumed with lasing on the vibrational band at line center of the transition having maximum gain. An analysis of cavity and chemical mechanisms yields a simple relationship between the pumping and depletion rates of the vibrational levels. This relationship is used to make a comprehensive study of the effects of cavity and chemical parameters on the laser pulse. The effect of changes in uncertain chemical reaction rate coefficients is assessed.
Author (GRA)

N73-10532# Ohio State Univ., Columbus. Electroscience Lab.
LASER ABSORPTION IN THE 5 MICRON BAND Quarterly Technical Report, 23 Sep. - 23 Dec. 1971
Dale L. Ford and Ronald Long Griffiss AFB, N. Y. RADC Apr. 1972 57 p refs
(Contract F30602-72-C-0016; ARPA Order 1279)
(AD-745585; ESL-3271-2; RADC-TR-72-140) Avail: NTIS CSCL 20/5

Atmospheric transmittance calculations are made for five atmospheric models with water vapor as the molecular absorber. Transmittance plots are shown for these models in the spectral region of 1840 to 1990/cm. The effect of varying some of the parameters involved in the calculation of atmospheric transmittance is investigated at several CO laser wavelengths. Experimentally, tests made on the absorption cell showed that water vapor adsorption onto the cell walls is small but not insignificant. The components of the CO laser system have been installed and the laser has been operated. Author (GRA)

N73-10533# Radio Corp. of America, Burlington, Mass. Advanced Technology Labs.
HOLOGRAPHIC MULTICOLOR MOVING MAP DISPLAY (LABORATORY MODEL) Final Report, 1 Feb. 1971 - 30 Jun. 1972
Gardner T. Burton, Burton R. Clay, Douglas A. Gore, Louis A. Perretta, and Ronald E. Tetrev Jun. 1972 115 p ref
(Contract N62269-71-C-0134)
(AD-745025) Avail: NTIS CSCL 17/7

High performance aircraft present the problem of providing navigational information to a pilot (or navigator) in a quick, clear and concise manner. This requirement has led to the development of the concept of the moving map display - for use in the cockpit of an aircraft - which is driven directly by the aircraft's navigational equipment. This report describes work accomplished during the course of a one-year program to design and construct a laboratory demonstration model of a moving map display system, using a concept which employs holographic storage and display techniques. This exploratory program was the second in a proposed series of programs leading to the generation of an advanced moving map display system. Author (GRA)

N73-10534# Aerospace Corp., El Segundo, Calif. Lab. Operations.
FLAME SHEET ANALYSIS OF CW DIFFUSION TYPE CHEMICAL LASERS: COUPLED RADIATION Research Report, Feb. - Apr. 1971
Robert Hofland, Jr. and Harold Mirels 25 May 1972 57 p refs
(Contract F04701-71-C-0172)
(AD-745311; TR-0172(2240-10)-3; SAMSO-TR-72-105) Avail: NTIS CSCL 20/5

The uncoupled radiation analysis of diffusion-type chemical lasers is modified to treat coupled collisional and radiative relaxation of vibrationally excited lasing diatomics for the limiting case of a radiatively saturated medium. Closed-form expressions for HF and DF laser performance are obtained that show dependence on experimental quantities, gas transport properties, and vibrational and chemical rate processes. The V - T portion of the vibrational energy-transfer model of an earlier report is generalized so that the relative importance of each collision partner in V - T energy transfer can be assessed. General scaling laws are derived that indicate different dependencies of laser performance on stoichiometry and temperature, depending on which species are dominant in vibrational de-excitation of HF(v); the scaling laws for the effect of gas pressure and oxidizer-channel height on laser power and efficiency are unchanged from those deduced in the earlier report.
Author (GRA)

N73-10535# Honeywell, Inc., Bloomington, Minn. Corporate Research Center.
PREPARATION AND CHARACTERIZATION OF POLYCRYSTALLINE HALIDES FOR USE IN HIGH POWER LASER WINDOWS Quarterly Technical Report, 1 Apr. - 30 Jun. 1972
G. E. Bernal, R. J. Stokes, B. F. Koepke, and R. H. Anderson Jun. 1972 21 p
(Contract DAHC15-72-C-0227; ARPA Order A02172)
(AD-745350; HR-72-266-5-26; QTR-1) Avail: NTIS CSCL 20/6

The purpose of the program was to define methods of producing polycrystalline halide materials with improved mechanical properties while maintaining the desirable optical properties of the single crystal materials. The report presents preliminary research emphasizing material-processing techniques and the development of test facilities to evaluate the optical and mechanical properties of the materials produced. The materials processing techniques investigated to date are hot press forging and hot extrusion of KCl single crystals. The authors have succeeded in preparing polycrystalline materials that appear to

approach single crystals in optical quality and that have improved mechanical properties. Author (GRA)

N73-10536# Lockheed Missiles and Space Co., Huntsville, Ala.
DEVELOPMENT AND APPLICATION OF ANALYTICAL MODELS FOR CHEMICAL LASERS Midterm Report, 10 Jan. - 10 Jul. 1972
Alan W. Ratliff and Jurcen Thoenes 7 Jul. 1972 52 p refs
(Contract DAAH01-72-0493)
(AD-745419; LMSC/HREC-D306045; HREC-0493-1) Avail: NTIS CSCL 20/5

The objective of this effort is to apply existing flowfield models, (including combustion, mixing, and nonequilibrium chemistry) which have already been substantially verified in rocket applications, to the CW chemical laser. Modifications will be made to the programs so that the laser radiation effects can be coupled with the flow field. Parameters and geometry will be varied within the capability of the models in order to optimize the flow regimes for the chemical laser. In addition, analyses will be performed on the flow fields of existing lasers to define optimum operating conditions and interpret experimental results. GRA

N73-10537# Wayne State Univ., Detroit, Mich.
A STUDY OF ENERGY TRANSFER PROCESSES IN MOLECULAR LASERS Interim Technical Report
Alexander J. Glass 31 May 1972 4 p refs
(Contract DA-ARO(D)-31-124-71-G82; ARPA Order 675)
(AD-745368) Avail: NTIS CSCL 20/5

A study of energy transfer processes in molecular lasers is being carried out. The document is an interim report on progress to date accomplished under this grant. GRA

N73-10538# Optitron, Inc., Los Angeles, Calif.
NERNST LAMP FOR LASER PUMPING
May 1972 24 p refs
(Contract N00014-72-C-0071)
(AD-745796) Avail: NTIS CSCL 20/5

The report is concerned with the application of Nernst glower (Metal-Oxide Conductors) to Laser pumping with the specific objective to produce spectral energy largely within the pumping band of the laser material, while minimizing the radiant energy elsewhere. The contract is exploratory in nature with a large portion of the effort devoted to material research and advanced spectroscopy targeted toward achieving a combination of increased efficiency and life in laser pumps. Author (GRA)

N73-10539# Naval Research Lab., Washington, D.C.
A WAVE OPTICS CALCULATION OF PULSED LASER PROPAGATION IN GASES Interim Report
Peter B. Ulrich 7 Jun. 1972 18 p refs
(AD-745739; NRL-7413) Avail: NTIS CSCL 20/5

The theoretical description of the thermal blooming of pulsed, focused laser beams has been improved by using the equations of wave optics. Previous approximations of the actual situation have used a geometrical optics formulation to describe the beam. Results are in the form of formulas which provide dependence of the beam degradation on the parameters of the problem. Such formulas will prove useful in understanding and collating numerical studies of the full nonlinear problem. Author (GRA)

N73-10540# Raytheon Co., Waltham, Mass. Research Div.
RESEARCH AND DEVELOPMENT OF YTTRIUM ALUMINATE LASERS Final Report, 4 Jan. 1971 - 3 Jan. 1972
Marvin J. Weber and Michael Bass Wright-Patterson AFB, Ohio AFML Jun. 1972 127 p refs
(Contract F33615-71-C-1212; AF Proj. 7371)
(AD-746032; S-1402; AFML-TR-75-32) Avail: NTIS CSCL 20/5

Yttrium orthoaluminate (YAlO3) doped with rare earth ions is investigated for use as an optically-pumped laser material. Two laser ions are studied in detail: neodymium (Nd3-) and holmium (Ho3-) sensitized with erbium and thulium. Measurements of optical absorption and emission spectra, fluorescence kinetics, and stimulated emission corss section are reported. Nd:YAlO3 laser rods are oriented along the three principal crystallographic directions were tested in long-pulse, Q-switched, and CW operation. The laser outputs and efficiencies of Nd:YAlO3 are compared with those obtained from Nd:YAG in the same operating configuration. Ho:YAlO3 laser action is investigated at liquid nitrogen temperatures. Long-pulse and Q-switched laser performance is reported for three different rod orientations. To provide information for predicting laser action and performance of other rare-earth ions in YAlO3, experiments and calculations of radiative transitions probabilities and of nonradiative decay by multiphonon emissions are presented. Author (GRA)

N73-10541# Institute for Defense Analyses, Arlington, Va. Jason Div.
REPORT OF THE 1971 JASON LASER SUMMER STUDY. VOLUME 1: RECOMMENDATIONS AND CONCLUSIONS
Kenneth Watson, Kenneth Case, Roger Dashen, Normal Kroll, and Malvin Ruderman Aug. 1971 36 p
(Contract DAHC15-67-C-0011)
(AD-743098; S-391-1-Vol-1; IDA/HQ-71-13167-1) Avail: NTIS CSCL 20/5

All potential uses of lasers, civil and military, are reviewed: medicine and biological research, chemical processing, initiation of controlled thermonuclear reactions, communications, pollutant detection and monitoring, geoscience applications, holographic applications, manufacturing and related processes, and basic research. Recommendations are made concerning Federal encouragement, funding, and coordination of further effort in these area and in laser technology and device development. Author (GRA)

N73-10542# Naval Postgraduate School, Monterey, Calif.
CONSTRUCTION OF A CARBON DIOXIDE TEA (TRANSVERSELY EXCITED ATMOSPHERIC) LASER M.S. Thesis
Douglas Harmon Barr Jun. 1972 56 p refs
(AD-745842) Avail: NTIS CSCL 20/5

The recent development of CO2 Transverse Excitation at Atmospheric Pressure (TEA) lasers has generated expanding interest and success due to their high pulsed power capabilities and simplicity of construction. The authors therefore decided to construct a CO2 TEA laser because of the need for a high powered, pulsed, coherent radiation source with wave length near 10 microns to conduct absorption studies of laser-induced plasmas. It was decided that the constructed laser should have an output energy per pulse between 10 to 50 joules with a pulse time between 0.1 to 1.0 microseconds. This paper deals with the construction of that laser, and includes a discussion of the background and physics of operation of the CO2 TEA laser. Author (GRA)

N73-10543# United Aircraft Corp., East Hartford, Conn. Research Labs.
RESEARCH INVESTIGATION OF THE GENERATION, MEASUREMENT, AND PROPERTIES OF PICOSECOND LASER PULSES Final Report, 1 Jan. 1970 - 30 Apr. 1972
William H. Glenn 28 Apr. 1972 107 p refs
(Contract F19628-70-C-0159; AF Proj. 4645)
(AD-746310; UARL-L920935-8; AFCRL-72-0275) Avail: NTIS CSCL 20/5

The report summarizes a number of research projects concerned with the generation, measurement, and properties of picosecond laser pulses produced by mode-locked lasers. Topics discussed include a theory of the two photon absorption-fluorescence method of pulse width measurement, a statistical model of the mode-locking process that is capable of explaining many of the observed features, a comparison of the model with experimental results, experiments with time-resolved spectroscopy and experiments with a novel type of nonlinear optical element that is potentially useful for mode-locking. Author (GRA)

N73-10544# Ohio State Univ., Columbus. Electroscience Lab.
INVESTIGATION OF LASER PROPAGATION PHENOMENA Final Report, 1 Jan. 1971 - 28 Feb. 1972
Stuart A. Collins Apr. 1972 79 p refs
(Contract F30602-71-C-0132; ARPA Order 1279)
(AD-746053; ESL-3163-3; RADC-TR-72-123) Avail: NTIS CSCL 20/6

The report contains detailed information on the theoretical efforts of Ohio State University conducted in direct support of the RADC Laser Propagation Program. The efforts described are concentrated in three main areas: the examination of proper

averaging times required for specific propagation experiments; the calculation of theoretical curves predicting results of various experiments along slant paths; and the calculation of predicted results for the temporal spectra of particular atmospheric effects. The atmospheric effects included in the analysis are; phase structure function, angle of arrival and coherence length. Both the spatial and temporal characteristics have been considered. Author (GRA)

N73-10545# Naval Underwater Systems Center, Newport, R.I.
APPLICATIONS OF HOLOGRAPHIC INTERFEROMETRY IN UNDERWATER ACOUSTICS RESEARCH
Cameron D. Johnson and Gerald M. Mayer 23 Jun. 1972 21 p refs
(AD-746134; NUSC-TR-4353) Avail: NTIS CSCL 14/2

Holographic interferometry has gained wide acceptance as a nondestructive testing and vibration analysis technique since its introduction in 1965. The report outlines the history of holographic interferometry, describes the holography process, and describes several applications representative of the present state of the art of holographic interferometry that are particularly relevant to underwater acoustics work. Potential future applications are presented for consideration. Author (GRA)

N73-10546# National Materials Advisory Board, Washington, D.C.
HIGH POWER INFRARED LASER WINDOWS Final Report
Jul. 1972 152 p refs
(Contract DA-49-083-OSA-3131)
(AD-745927; NMAB-292) Avail: NTIS CSCL 20/5

The successful development of powerful infrared (IR) lasers, notably various types of CO2 lasers and certain chemical lasers, during the past five years has opened up many applications for IR-laser beams. The report of the Committee reviews in detail the state of the art and problems presented by each of the seven subject areas into which the field could be divided. These are: Propagation of IR Radiation in Window Materials; Fundamental Absorption Mechanisms; Experimental Aspects in the Characterization of High-Power IR-Window Materials; Single Crystal II-VI, III-V, and IV IR-Window Materials; Chalcogenide Glass IR-Window Materials; and Polycrystalline IR-Window Materials. Author (GRA)

N73-10547# Naval Weapons Lab., Dahlgren, Va.
ULTRASONIC IMAGING OF CYLINDRICAL EXPLOSIVE LOADS
Carol E. Springer Apr. 1972 40 p refs
(AD-746468; NWL-TR-2737) Avail: NTIS CSCL 14/2

Acoustic holography has been used successfully to image a simulant of the explosive PBXW106. Flaws less than 1/8 inch can be detected in glass bead simulants which are 1/2 inch in thickness, using a frequency of 1 MHz at 300 watts peak power. With these results, calculations were made which show that the explosive can be imaged. Flaws and density differences in the explosive can be determined at or near this same frequency. An outline of a total, automated inspection system is given with detailed descriptions of the linear receiving array and the sonifying phased array. The liquid surface system currently being used for a research tool is also described. Author (GRA)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N73-10548 National Lending Library for Science and Technology, Boston Spa (England).
THROWING POWERS OF VARIOUS NICKEL PLATING BATHS
T. Hayashi and S. Fujiwara Jul. 1972 10 p refs Transl. into ENGLISH from Kinzoku Hyomen Gijutsu (Tokuo), v. 21, no. 5, 1970 p 40-44 (286-290)
(NLL-RTS-7294) Avail: Natl. Lending Library, Boston Spa, Engl.: £0.90 or 3 NLL photocopy coupons

The throwing powers of various types of nickel plating baths using a Hull cell were investigated and comparative examinations of the differences in throwing power according to bath composition are outlined. Results indicate an ordinary nickel bath, a nickel chlorine bath, a sodium chloride bath, and a high sulfate bath show the greatest throwing powers. A Watt bath, sulfate bath, high sulfamate bath, and a potassium chloride bath were moderate in throwing power, while fluoborate bath and citrate bath were the poorest in throwing power. Experimental results also established that the throwing power varied according to the anion species. Author

N73-10549*# Case Western Reserve Univ., Cleveland, Ohio. Div. of Metallurgy and Materials Science.
ELEVATED TEMPERATURE DEFORMATION OF TD-NICKEL BASE ALLOYS Annual Status Report
J. J. Petrovic, R. D. Kane, and L. J. Ebert Aug. 1972 222 p refs
(Grant NGR-36-003-094)
(NASA-CR-128403) Avail: NTIS HC $13.25 CSCL 11F

Sensitivity of the elevated temperature deformation of TD-nickel to grain size and shape was examined in both tension and creep. Elevated temperature strength increased with increasing grain diameter and increasing L/D ratio. Measured activation enthalpies in tension and creep were not the same. In tension, the internal stress was not proportional to the shear modulus. Creep activation enthalpies increased with increasing L/D ratio and increasing grain diameter, to high values compared with that of the self diffusion enthalpy. It has been postulated that two concurrent processes contribute to the elevated temperature deformation of polycrystalline TD-nickel: (1) diffusion controlled grain boundary sliding, and (2) dislocation motion. Author

N73-10550# Defence Research Information Centre, Orpington (England).
A STUDY OF THE CORROSION CRACKING OF Al-Zn-Mg-Cu ALLOYS
V. D. Valikov, V. C. Sinyarski et al Mar. 1972 15 p refs Transl. into ENGLISH from Korroziya i Zashcita Metal., Sb. (Moscow), v. 6, 1970 p 75-83
(AD-742106; DRIC-Trans-2682; DRIC-BR-30051) Avail: NTIS CSCL 11/6

The paper gives experimental data on the resistance of sheets to corrosion in relation to chemical composition, method of heat treatment, and production techniques. GRA

N73-10551# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF THE TEMPERATURE-TIME DEPENDENCE OF THE STRENGTH AND DURABILITY OF AG-4S AND EF-S SHEET GLASS PLASTICS UNDER TENSION, COMPRESSION, AND BENDING UNDER TENSION, COMPRESSION, AND BENDING UNDER CONDITIONS OF PROGRAMMED ONE-SIDED HEATING
M. G. Lozinskii, G. Ye. Vishnevskiy, and A. I. Pavlov 31 Jan. 1972 19 p refs Transl. into ENGLISH from the publ. "Termoprochnost Materialov i Konstruktsionnykh Elementov" Kiev, Naukova Dumka, 1965 p 113-123
(AD-743694; FTD-MT-24-1778-71) Avail: NTIS CSCL 11/6

The construction and the methods of conducting tests with the IMASh-11 machine are described. The authors describe the conduct and results of tests performed to measure the variation of the strength of sheet specimens of glass plastics AG-4S and EF-S with the level of initial constant stress. Strength and durability characteristics of the materials were measured in conditions of tension, compression, and shear. GRA

N73-10552# Naval Research Lab., Washington, D.C.
DAMAGE FUNCTION ANALYSIS OF NEUTRON EMBRITTLEMENT IN STEEL AT REACTOR SERVICE TEMPERATURES Final Report
Charles Z. Serpan, Jr. 8 Jun. 1972 20 p refs
(AD-745299; NRL-7405) Avail: NTIS CSCL 11/6

Neutron-induced increases in the brittle-ductile transition temperature (delta TT) of A302-B pressure vessel steel have been measured from irradiations in a number of reactor environments for neutron fluences representative of pressure vessel

design lifetimes. While these measurements have permitted formulation of the trends necessary for delta TT projections in operating reactors, certain anomalous results have been observed wherein measurements fell outside the nominal limits of the trends. As a summation of research on this steel and to resolve the anomalous results, a damage function was derived for the neutron-induced delta TT response of A302-B steel at reactor operating temperatures. The damage function is a series of weighting factors for the damaging capacity of neutrons of all energy groups in a reactor spectrum; these factors thus indicate the relative importance of specific energy-group neutrons to the damaging process. Techniques for derivation of the damage function and the complementing correlation-evaluation method are directly applicable to more advanced reactor systems.
Author (GRA)

N73-10553# Aerospace Corp., El Segundo, Calif. Lab. Operations.
STRESS HISTORY EFFECT ON INCUBATION TIME FOR STRESS CORROSION CRACK GROWTH IN E-4340 HR STEEL Research Report, Jun. - Dec. 1971
Dennis L. Dull and Louis Raymond 15 Jun. 1972 29 p refs
(Contract F04701-71-C-0172)
(AD-745308; TR-0172(2250-10)-7; SAMSO-TR-72-168) Avail: NTIS CSCL 11/6

The effect of stress history on stress corrosion cracking of E-4340 HR steel in an aqueous environment has been studied with the use of double-cantilever beam specimens. The stress history effect was found to influence the incubation time period with changes in the stress intensity. When the stress intensity was decreased, the incubation time period was dependent on the delta K and final K sub f during stress corrosion testing. When the stress intensity was increased, the incubation time period was independent of the applied stress intensity. However, the stress history effect did not influence the steady-state crack growth rates. In this report, the stress history effect is explained by using the hydrogen embrittlement mechanism.
Author (GRA)

N73-10554# Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.
THE OXIDATION OF TANTALUM
Kenneth R. Lawless and Dennis J. Kampe May 1972 173 p refs
(Contract N00014-69-A-0060-0002; NR Proj. 036-010)
(AD-745341; MS-3531-112-72U) Avail: NTIS CSCL 11/6

Scanning electron microscopy (SEM) in conjunction with transmission electron microscopy (TEM) and optical microscopy was used to study the initial stages of the oxidation of high purity (111) and (110) Ta single crystals and large-grained 5 mil-thick sheet of approximately (001) orientation. Two different oxidation temperatures 530C and 800C were used as well as two different pressures, 1 atmosphere and typically 0.001 torr oxygen.
Author (GRA)

N73-10555# Army Foreign Science and Technology Center, Charlottesville, Va.
THE INFLUENCES OF SHOCK COMPRESSION PRESSURE ON CRITICAL SHEAR STRESS IN METALS
S. A. Novikov and L. M. Sinitsyna 13 Jun. 1972 7 p refs Transl. into ENGLISH from Zh. Prik. Mekhan i Tekhn. Fiz. (Moscow), no. 6, 1970 p 107-110
(AD-745365; FSTC-HT-23-1060-72) Avail: NTIS CSCL 11/6

Explosive experiments were performed to study the critical shear stress beyond the leading edge of shockwaves in aluminum at pressures of 300 and 650 kbar, copper in pressures of 240 and 550 kbar and lead at pressures of 460 kbar. Estimates of this quantity were performed by comparison of experimental data characterizing the decrease in pressure across the leading edge of the shockwave due to unloading with the results of calculation.
Author (GRA)

N73-10556# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMAL EXPANSION OF THE SOLID SOLUTIONS OF REFRACTORY METALS IN GROUPS 4, 5, AND 6 OF THE PERIODIC SYSTEM
K. S. Pridantseva and N. A. Solovyeva 22 Apr. 1972 14 p refs Transl. into ENGLISH from the publ. "Vysokotemperaturnyye Neorganicheskiye Soyedineniya" Kiev, Naukova Dumka, 1965 p 41-47
(AD-745847; FTD-MT-24-1396-71) Avail: NTIS CSCL 11/6

As a result of studying the thermal expansion of the solid solutions of refractory metals in groups IV, V and VI of the periodic system it has been established that in the curves of the dependence of the coefficient of thermal expansion upon composition in all the investigated solid solutions, no minima of maxima inherent in alloys with a ferromagnetic anomaly or in the alloys in which phases of the delta-phase are formed have been detected. In all cases the coefficient of thermal expansion of the single-phase solid solutions of refractory metals has either an approximately linear dependence upon composition (chromium-vanadium, chromium-molybdenum, molybdenum-niobium, zirconium-titanium), or changes on a curve.
Author (GRA)

N73-10557# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMAL EXPANSION COEFFICIENTS AND ELASTIC MODULI OF IRON SILICIDES
L. P. Andreeva and P. V. Geld 28 Apr. 1972 18 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Chernaya Met. (Moscow), no. 2, 1965 p 111-117
(AD-745825; FTD-MT-24-1427-71) Avail: NTIS CSCL 11/6

Thermal expansion coefficients and elastic moduli of solid solutions of silicon in given solutions are studied. Data is given on the chemical and phase compositions and density of the specimens.
Author (GRA)

N73-10558# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF CHARGE AND MELTING CONDITIONS ON THE QUALITY OF COPPER ALLOYS
V. M. Chursin, A. I. Pimenov, and Yu. V. Degtyarev 2 May 1972 14 p refs Transl. into ENGLISH from the book "Osnovy Obrazov. Liteinkh Splavov" USSR, 1970 p 326-330
(AF Proj. 7351)
(AD-745845; FTD-HT-23-578-72) Avail: NTIS CSCL 11/6

The influence of charge materials, melting condition and type of melting apparatus on gas content (particularly hydrogen) of copper alloys was studied.
Author (GRA)

N73-10559# Army Foreign Science and Technology Center, Charlottesville, Va.
NEW 4Kh4M2VFS DIE STEEL FOR HIGH TEMPERATURE DEFORMATION OF HEAT-RESISTANT METALS AND ALLOYS
S. I. Tishaev, L. A. Poznyak, V. F. Smolyakov, A. I. Serebryanskaya, I. A. Pospelov, G. Kh. Gabuyev, and M. A. Sklyar 17 Apr. 1972 9 p refs Transl. into ENGLISH from Kuznechno-Shtampovochnoe Proizvod. (USSR), no. 4, 1970 p 15-17
(AD-745703; FSTC-HT-23-1412-71) Avail: NTIS CSCL 11/6

The article describes a study of the basic (service) properties of the new 4Kh4M2VFS (DI-22) tool steel and the best known domestic and foreign steels of this type, as well as the operating life of dies of 4Kh4M2VFS steel in hot deformation of stainless and heat-resistant steels and alloys.
Author (GRA)

N73-10560# Army Materials and Mechanics Research Center, Watertown, Mass.
DEVELOPMENT OF A STRESS CORROSION CRACKING TEST FOR ARMOR ALLOYS
Daniel B. Dawson Jun. 1972 20 p refs
(AD-746251; AMMRC-PTR-72-1) Avail: NTIS CSCL 11/6

A stress corrosion test has been developed for use with high-hardness armor alloys. It is self-loaded, and it can be used with any armor plate thickness. Initial trials have proven the validity of the test method, although several refinements are recommended. Further study is needed to determine whether or not the test method can be applied to specification and qualification test procedure. Data produced to date on one plate of XAR-30 high-harness steel armor show that it is very susceptible to stress corrosion with K9I(scc) values from 15 to 19 ksi (sq root of inch).
Author (GRA)

N73-10561# Rensselaer Polytechnic Inst., Troy, N.Y. Materials Div.

EFFECT OF TITANIUM ADDITIONS ON THE AGING CHARACTERISTICS OF AN Al-Zn-Mg ALLOY
Gary Judd and C. A. Grove 4 Aug. 1972 27 p refs
(Contract N00014-67-A-0117-0009)
(AD-746195; TR-4) Avail: NTIS CSCL 11/6

A minute titanium addition (.04%) was added to an Al-Zn-Mg alloy in order to determine the effect of titanium on microstructure and aging characteristics of this alloy. Titanium was found to retard the kinetics of precipitation and to prevent solute segregation to grain boundaries on air quenching. Below G.P. solvus temperature, hardening of the alloy was due both to dislocation loop formation and to G.P. zone formation. Above G.P. solvus temperature, hardening was due only to formation of precipitate. These results have been explained in terms of titanium reducing the likelihood of the formation of solute vacancy complexes causing a reduction in zinc and magnesium mobility.
Author (GRA)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N73-10562 National Lending Library for Science and Technology, Boston Spa (England).
BORONIZATION OF STEEL SURFACES BY B4C-ALKALI METAL CARBONATES
A. Muta Jul. 1972 13 p refs Transl. into ENGLISH from Nippon Kinzoku Gakkaishi (Sendai City), v. 32, no. 5, 1968 p 440-443
(NLL-RTS-7197) Avail. Natl. Lending Library, Boston Spa, Engl.: £1.20 or 4 NLL photocopy coupons

A solid boronization process for coating steel surfaces is presented. The method encompasses immersing a steel sample in a molten NaOCN bath and then coating the sample with B4C powder after which heat is applied in a sealed atmosphere. When compared to other processes, the present method gives a thicker boronized layer with less solidification of the powdered boronization agent. In addition, the boronized sample has superior wear properties.
Author

N73-10563 National Lending Library for Science and Technology, Boston Spa (England).
METHODS OF PREPARING PURE CARBIDES
T. Ya. Kosolapova and G. N. Makarenko Jul. 1972 10 p refs Transl. into ENGLISH from "Tugoplavkie Karbidy" Kiev, 1970 p 16-20
(NLL-RTS-7315) Avail: Natl. Lending Library, Boston Spa, Engl.: £1.00; 3 NLL photocopy coupons

The method of gas precipitation is used to obtain high purity carbides in both the polycrystalline and monocrystalline states. Conditions are outlined for the preparation of zirconium carbides and niobium carbides by reduction of metal chloride vapors and carbon tetrachloride with hydrogen. Results indicate that the obtained products are of strictly stoichiometric composition.
Author

N73-10564 National Lending Library for Science and Technology, Boston Spa (England).
EFFECT OF HEAT TREATMENT ON THE ADSORPTION PROPERTIES OF TITANO-SILICA GEL
N. F. Ermolenko and M. I. Yatsevskaya Jul. 1972 6 p refs Transl. into ENGLISH from Dokl. Akad. Nauk Belorussk. SSR (Minsk), v. 15, no. 12, 1971 p 1092-1094
(NLL-RTS-7360) Avail: Natl. Lending Library Boston Spa, Engl.: £0.60; 2 NLL photocopy coupons

The effect of heat treatment on the adsorption properties of titano-silica gel is discussed. The specific interactions of the absorbed molecules with the silanol groups of the surface are examined. It was determined that dehydroxylation of the silica gel surface on calcination and its modification by substituting the hydroxyl groups with fluorine or organic radicals result in decrease in the specific reactions with the molecules being adsorbed. The effect of modifying silica gel KSK by depositing a layer of titanium dioxide on its surface to alter its adsorption properties on calcination in the temperature range of 200 to 800 C was investigated.
Author

N73-10565 National Lending Library for Science and Technology, Boston Spa (England).
ASPECTS OF A THEORY OF CARBIDE PROPERTIES
G. V. Samsonov Jul. 1972 11 p refs Transl. into ENGLISH from the pub. "Tugoplavkie karbidy" Kiev, 1970 p 9-15
(NLL-RTS-7334) Avail: Natl. Lending Library, Boston Spa, Engl.: £1.10; 4 NLL photocopy coupons

The development of a chemical model to present the properties of carbides is discussed. The application of the model to the characteristics of the electron structure of the carbides of d-transition metals is examined. The application of the configurational localization model shows that the factors primarily determining the level of the properties of carbides are the statistical weight of the carbon atoms and the concentration of the surplus non-localized electrons in the carbide lattice.
Author

N73-10566 National Lending Library for Science and Technology, Boston Spa (England).
THE ERRORS OF ACTINOMETRIC INSTRUMENTS WITH A POLYETHYLENE SHIELD
A. I. Gubernatorv and G. N. Kostanoj [1972] 6 p refs Transl. into ENGLISH from Tr. Tsentr. Aerolog. Observ. (Moscow), v. 102, 1971 p 37-41 No diagrams etc.; to be used in conjunction with original book
(NLL-M-22675-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The application of polyethylene as a wind protective screen for actinometric instruments is discussed. The properties of polyethylene as a suitable material for radiation windows are examined. The physical and mechanical properties of polyethylene are described. The proper use of polyethylene screens to avoid deterioration of a series of parameters of the actinometric instruments is explained.
Author

N73-10567*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPLORATORY EVALUATION OF CERAMICS FOR AUTOMOBILE THERMAL REACTORS
Phillip L. Stone and Charles P. Blankenship 1972 30 p refs Proposed for presentation at Intern. Automotive Eng. Congr. and Exposition, Detroit, 8-12 Jan. 1973; sponsored by SAE
(NASA-TM-X-68148; E-7175) Avail: NTIS HC $3.50 CSCL 11B

An exploratory evaluation of ceramics for automobile thermal reactors was conducted. Potential ceramic materials were evaluated in several reactor designs using both engine dynamometer and vehicle road tests. Silicon carbide contained in a corrugated metal support structure exhibited the best performance lasting over 800 hours in engine dynamometer tests and over 15,000 miles (24,200 km) of vehicle road tests. Reactors containing glass-ceramic components did not perform as well as silicon carbide. But the glass-ceramics still offer good potential for reactor use. The results of this study are considered to be a reasonable demonstration of the potential use of ceramics in thermal reactors.
Author

N73-10568# Oxford Univ. (England). Dept. of Engineering.
THE EFFECTS OF STRAIN RATE AND TEMPERATURE ON THE DEFORMATION BEHAVIOUR OF REINFORCED AND UNREINFORCED EPOXY RESIN
E. Pink and J. D. Campbell Jul. 1972 43 p refs
(Rept-1040/72) Avail: NTIS HC $4.25

Tensile specimens of epoxy resin, and of the same resin reinforced by layers of close-weave glass cloth, have been tested at low strain rates (0.00033 to 0.0165/sec) over a wide range of temperatures (77 to 380 K). Stress-strain curves, elastic moduli, and fracture stresses have been determined as functions of temperature and fiber orientation. The rate sensitivities of the unreinforced resin and of the composite have been measured by strain rate change tests, and activation parameters have been determined, by means of which it has proved possible to correlate the behavior of the pure epoxy and of composites with various orientations of the fibers.
Author (ESRO)

N73-10569# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
COMPOSITE COMPATIBILITY Final Scientific Report, Jul. 1968 - Nov. 1970
William R. Kerr Apr. 1972 12 p refs
(AF Proj. 7021)
(AD-745324; ARL-72-0055) Avail: NTIS CSCL 11/4

An investigation of the rate of transport of oxygen through the matrix in a tungsten filament-copper matrix composite indicates that the rate of transport and rate of oxidation of the filament is more dependent upon processing variables than on the bulk diffusion rate. Author (GRA)

N73-10570# National Research Corp., Cambridge, Mass.
DEVELOPMENT OF LAMINATE METAL MATRIX COMPOSITES Final Report, 16 Apr. 1971 - 15 Apr. 1972
M. J. Hordon May 1972 51 p refs
(Contract N00019-71-C-0183)
(AD-745002; NRC-TR-72-506) Avail: NTIS CSCL 11/4

Boron carbide-reinforced titanium laminate composites were fabricated containing up to 50 percent B4C volume fraction with interlaminar spacings in the range 7 - 25 micrometers. Mechanical properties increased with B4C content. At the 50 percent B4C level, the biaxial tensile elastic modulus was 245 GN/sq, and the biaxial fracture strength was approximately 665 MN/sq at 20C and about 300 MN/sq at 650C. Fracture energy values derived from Charpy impact tests were 40.7 KJ/sq for loads applied transverse to the laminar plane and 25.4 KJ/sq for loads applied parallel to the laminar plane. The B4C-Ti laminates resisted extended cyclic thermal exposures to 650C with minimal residual strength loss or distortion. Author (GRA)

N73-10571# Army Coating and Chemical Lab., Aberdeen Proving Ground, Md.
ELECTRODE POTENTIAL MEASUREMENTS OF CHEMICAL CONVERSION COATINGS FOR FERROUS METALS Final Report
William H. Deaver Jun. 1972 15 p refs
(DA Proj. 1T0-62105-A-329)
(AD-745094; CCL-305) Avail: NTIS CSCL 11/3

A method was developed to measure electrode potential as a means to determine the quality of zinc phosphate coatings conforming to TT-C-490, Type 1. Electrode potential was measured on bare steel and on steel phosphate treated for 30 seconds, 1, 2, 3 and 5 minutes. Although the method differentiated between untreated and treated steel, it did not differentiate between the various levels of treatment time. Author (GRA)

N73-10572# Naval Postgraduate School, Monterey, Calif.
AN INVESTIGATION OF INITIAL YIELD SURFACES FOR UNIDIRECTIONAL REINFORCED COMPOSITES M.S. Thesis
Walter Alfred Ericson Mar. 1972 203 p refs
(AD-745176) Avail: NTIS CSCL 11/4

Initial yield surfaces of unidirectional fiber reinforced composites subjected to combined longitudinal, transverse normal, and longitudinal shear loads are calculated. The composite is composed of filaments arranged in a periodic square array embedded in a matrix material. The constituent materials are assumed to be homogeneous and isotropic, while the composite is assumed to be macroscopically homogeneous and transversely isotropic. The finite element method, using linear strain triangles, is employed to calculate the stresses throughout the composite. Von Mises yield criterion is used to calculate the elastic limit of the local microscopic combined stresses in the composite. Author (GRA)

N73-10573# Allis (Louis) Co., Greendale, Wis. Power Electronics Center.
RESEARCH AND DEVELOPMENT OF DISCONTINUOUS FIBER REINFORCED LIGHT ALLOY Final Report, Mar. 1971 - Mar. 1972
Robert A. Hermann, Paul J. Lare, Fred Ordway, and Henry Hahn May 1972 58 p refs
(Contract N00017-71-C-4404)
(AD-745342; Rept-7016-FR) Avail: NTIS CSCL 11/4

Two approaches to the preparation of titanium alloy composites reinforced with silicon carbide fibers without objectionable fiber-matrix reaction were studied: (1) interposing a protective coating of cerium monosulfide between the fiber and matrix; (2) activated pressure sintering of the metal hydride with the fibers to produce consolidation under less severe conditions. Composites of 2024 aluminum reinforced with discontinuous graphite fibers (Thornel 75 and Modmor Type 1) were prepared by liquid-phase hot pressing of metal powder-fiber green bodies. Alignment of fibers was obtained by hot extrusion of the consolidated composite or camphene extrusion and layup of the original green body. GRA

N73-10574# Michigan Univ., Ann Arbor. Dept. of Materials and Metallurgical Engineering.
GLASSY CARBONS Semiannual Progress Report, 1 Jan. - 31 May 1972
Edward E. Hucke Jun. 1972 76 p refs
(Contract DAHC15-71-C-0283; ARPA Order 1824)
(AD-745347; Rept-01099) Avail: NTIS CSCL 11/2

A large group of glassy carbon samples has been produced by controlled curing and pyrolysis of furfural alcohol based resins. Various structural characterizations and key property measurements have also been made. Crack free samples with apparent densities ranging from .5 to 1.27 gm/cu cm, mean pore sizes from 50 Angstroms to 50 microns, B.E.T. surface areas from 20 to 500 sq m/gm, elastic modulus from 180,000 to 7,350,000 psi, compressive strength up to 55,000 psi, and tensile strength up to 10,850 psi, have been produced in section thickness up to 1.2 inches. X-ray and electron diffraction, together with electron microscopy have revealed various structural features at size levels from 20 Angstroms to 200 microns. Author (GRA)

N73-10575# North American Rockwell Corp., Thousand Oaks, Calif. Science Center.
INVESTIGATION OF ACOUSTIC EMISSION FROM CERAMIC MATERIALS Final Report, 25 May 1971 - 24 May 1972
Lloyd J. Graham and George A. Alers 19 May 1972 53 p refs
(Contract N00019-71-C-0344)
(AD-745000; SC513.6FR) Avail: NTIS CSCL 11/2

The frequency content, amplitude distribution, and rate of occurrence of acoustic emissions generated in model ceramic materials were determined. Single crystal MgO and glass, used as models of a ductile and a brittle ceramic, were mechanically loaded by three different means to produce rapid crack growth, controlled slow crack growth, and plastic deformation in both four-point bending and by cyclic bending at 100 cycles per second. A method was developed for easily determining the frequency spectrum of a single acoustic emission over the frequency range of 1 kHz to 3 MHz. The main results of the tests with the model materials were that no acoustic emissions were detected before rapid crack growth commenced or during slow crack growth in glass. Rapid crack growth produced acoustic emissions which had characteristic features in their frequency spectra which seemed to depend on the size of the crack produced. Acoustic emissions were generated and were easily detected during plastic deformation of single crystal MgO. Author (GRA)

N73-10576# Tel-Aviv Univ. (Israel). School of Engineering.
WAVE PROPAGATION FIBER REINFORCED MATERIALS Final Technical Report, 1 Oct. 1970 - 1 Jun. 1972
Yechiel Weitsman Apr. 1972 103 p refs
(Contract DAJA37-71-C-1579; DA Proj. 2O0-61102-B-13B)
(AD-745358) Avail: NTIS CSCL 11/4

The report is in two parts. The first part concerns the propagation of plane harmonic waves in materials reinforced by inextensible fibers. Three types of such waves can propagate in extended media and their propagation characteristics are strongly related to the directions of the fibers. The second part concerns the reflection of plane waves at plane boundary in materials reinforced by inextensible and almost inextensible fibers. GRA

N73-10577# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SILICONE CARBIDE HEAT RESISTING MATERIAL
S. A. Tsukerman, V. E. Kvin, and A. T. Kravchenko 22 Mar. 1972 9 p Transl. into ENGLISH from Mono. "Poroshkovaya Metallurgiya v Novoi Tekhnike" Moscow, 1968 p 63-67
(AF Proj. 668A)

(AD-745434; FTD-HC-23-2104-71) Avail: NTIS CSCL 11/2
The authors outline theoretical principles of obtaining oxidation-resistant composite materials and discuss factors which determine the properties of these materials, in particular silicon carbide-graphite (siliconized graphite). They also formulate requirements for the initial materials and indicate the fields of application of siliconized graphite. Author (GRA)

N73-10578# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Mechanics.
ALLEVIATION OF STRESS CONCENTRATION WITH ANALOGUE REINFORCEMENT
Toshiaki Chiba and Robert A. Heller Apr. 1972 56 p refs
(Contract DAAF07-69-C-0444; Proj. Themis)
(AD-745116; VPI-E-72-4) Avail: NTIS CSCL 11/4
In order to reduce the stress concentration around a hole in a plate, new, analogue reinforcements instead of reinforcing rings were used in this investigation. In two of these specimens, reinforcements with different volume fractions were arranged to coincide with the stress trajectories for an infinite plate with a hole under uniaxial tension. Two other specimens contained straight rectangular-grid type reinforcements with different volume fractions. These 0.005 in. thick brass reinforcements were made by using a photofabrication method. Specimens were then prepared by sandwiching these reinforcements between two epoxy resin plates. Plane specimens, i.e., without reinforcement, were also made of the same epoxy resin for comparison.
Author (GRA)

N73-10579# Acurex Corp., Mountain View, Calif. Aerotherm Div.
AEROTHERM GRAPHITE SURFACE KINETICS COMPUTER PROGRAM. VOLUME 1: PROGRAM DESCRIPTION AND SAMPLE PROBLEMS User's Manual
Jan. 1972 137 p refs
(Contract F04611-69-C-0081)
(AD-745440; Aerotherm-UM-72-25-Vol-1; AFRPL-TR-72-23-Vol-1) Avail: NTIS CSCL 11/2
A Fortran 4 computer code is described which computes thermochemical ablation rates of pyrolytic graphite surfaces, as a function of surface temperature and pressure, assuming all heterogeneous reactions at the surface are kinetically controlled. The calculation of the chemical state at the surface utilizes a film coefficient model which accounts for the unequal diffusion of species. All homogeneous reactions between gas-phase species adjacent to the surface are assumed to be in equilibrium. The specific surface reactions which are taken to be kinetically controlled include the reactions of condensed-phase carbon with water vapor, carbon dioxide, and hydrogen. Several options are available for computation of the boundary-layer edge state required in the diffusion model, including isentropic expansion or compression and normal or oblique shock wave calculation procedures.
Author (GRA)

N73-10580# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
CERAMIC SYSTEMS FOR MISSILE STRUCTURAL APPLICATIONS Final Report, 1 Apr. 1970 - 30 Nov. 1971
Joe N. Harris, Earle A. Welsh, John H. Murphy, Gilbert Barifield, and Clarence J. Swafford 30 Nov. 1971 103 p refs
(Contract N00017-70-C-4438)
(AD-745744; GIT-A-1246-FR) Avail: NTIS CSCL 09/5
The purpose was to perform research and development directed toward the development of techniques to fully exploit the potential of readily available ceramic systems for use as structural components in hypersonic missile applications.
Author (GRA)

N73-10581# Army Foreign Science and Technology Center, Charlottesville, Va.
HIGH TEMPERATURE STRENGTH OF COPPER REINFORCED WITH TUNGSTEN FIBERS
D. M. Karpinos, D. Umanskiy, V. N. Rudenko, and L. I. Tuchinsky 17 Apr. 1972 13 p refs Transl. into ENGLISH from Probl. Prochnosti v Mashinostr., Akad. Nauk SSSR, Inst. Mashinoved. (Moscow), no. 5, 1970
(AD-745700; FSTC-HT-23-8-72) Avail: NTIS CSCL 11/4
A study is presented of the strength and stability of tungsten-reinforced copper. Strength was higher than pure copper at all temperatures studied. Materials of this type made by hot dynamic extrusion are superior to any known heat-resistant copper alloys.
GRA

N73-10582# Army Foreign Science and Technology Center, Charlottesville, Va.
RADIATION RESISTANCE OF PAINT AND VARNISH COATINGS
Valerii Konstantinovich Knyazev 6 Jun. 1972 198 p refs Transl. into ENGLISH of the book "Radiats. Stoikost Lakokrasochnykh Polrytii" Moscow, 1971 184 p
(AD-745701; FSTC-HT-23-1143-72) Avail: NTIS CSCL 11/3
The book examines the problems in the use of paints and varnishes as protective coatings for industrial structures and equipment against radiation damage, and their resistance to radiation contamination.
GRA

N73-10583# California Univ., San Diego. Dept. of Applied Mechanics and Engineering Sciences.
ON THE OPENING OF A FINITE CRACK NORMAL TO AN INTERFACE
Noel E. Ashbaugh May 1972 30 p refs
(Grant AF-AFOSR-1957-70; AF Proj. 9782)
(AD-746033; TR-5; AFOSR-72-1192TR) Avail: NTIS CSCL 11/4
Stress fields are determined in the neighborhood of tips of a finite crack which is perpendicular and close to an interface between two bonded, dissimilar elastic materials. The present analysis complements earlier work by M-Isida who obtained limited results for this problem. Both analytical results for the behavior of the stress intensity factors are determined and accurate values of the factors are computed when the crack is close to the interface. These results indicate that growth toward the interface of a crack occurring in the harder material can be prevented for certain combinations of materials. In contrast, other combinations enhance the growth toward the interface of a crack in the softer material.
Author (GRA)

N73-10584# Army Materials and Mechanics Research Center, Watertown, Mass.
FABRICATION OF NOVEL COMPOSITES. PART 1: REACTIVE HOT-PRESSING OF GAMMA-Al2O3 WITH SYNTHETIC FLUORINE MICAS
James W. McCauley Feb. 1972 22 p refs
(DA Proj. 1T0-61101-A-91-A)
(AD-742207; AMMRC-TR-72-6-Pt-1) Avail: NTIS CSCL 11/4
The feasibility of fabricating lamellar ceramic-based composites with controllable and easily modified properties by reactive hot-pressing of Gamma-Al2O3 with potassium and barium fluorine micas has been successfully demonstrated. The Ba-mica/Al2O3 composites close to full density (98%) were fabricated at moderate processing conditions which exhibit a 4-point bend strength of 45,000 psi and an elastic modulus of 50,000,000 psi. It has also been established that eutectic-like MgAl2O4 (spinel)/Al2O3 composites can also be fabricated 700 C below the eutectic temperature by this technique. Mean Knoop (100) hardness values of 1500 have been measured on these composites.
Author (GRA)

N73-10585# Texas A&M Univ., College Station. Dept. of Civil Engineering.
LITERATURE SURVEY OF THE FIELD OF FIBER REINFORCED PLASTIC COMPOSITES: PART 2, AUGUST 1970 - JULY 1971
S. W. Beck, R. A. Schapery, and L. D. Webb Aug. 1971 93 p
(PB-210305; CMR-2-Pt-2) Avail: NTIS HC $3.00 CSCL 11D
The abstract from approximately 500 references in the area of fiber-reinforced plastic composites is presented. The survey covers publications from the period August 1970 through July 1971, with particular emphasis on boron, glass, and graphite fiber materials. The abstract presents an in-depth coverage of the mechanical, thermal, and optical characterization of fiber-reinforced plastics as well as the analytical methods used to predict laminate behavior on both the microscopic and macroscopic scale. The area of failure and the influence of physico-chemical effects on mechanical behavior are also reviewed. Finally, special

sections on design and application, materials and fabrication, and special test procedures are included. Author (GRA)

N73-10986* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Propulsion Div.
EXTENSIONAL FLOW OF BULK POLYMERS
T. J. Peng *In its* JPL Quart. Tech. Rev., Vol. 2, No. 3 Oct. 1972 p 40-45 refs (For availability see N73-10981 01-34) CSCL 11D

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N73-10586# RAND Corp., Santa Monica, Calif.
AN OPTIMIZATION ALGORITHM FOR CLUSTER ANALYSIS
Chris Roach Aug. 1972 15 p refs
(P-4878) Avail: NTIS HC $3.00

Given a set of N points and distances between all points, an algorithm is presented for determining an optimal partition of the points into k mutually exclusive and exhaustive subsets or clusters according to an objective function defined on the set of all partitions. The value of the objective function for a given partition is defined as the maximum within-cluster distance in the partition. The algorithm determines an optimal partition by solving a sequence of set-covering problems. The set-covering problems have no more than N constraints and typically less than 1.5 N variables. Author

N73-10587# Nottingham Univ. (England). Dept. of Geography.
COMPUTER APPLICATIONS IN THE NATURAL AND SOCIAL SCIENCES NO. 14: RANDOM NUMBER PACKAGE
H. Neave Jul. 1972 56 p refs
Avail: NTIS HC $5.00; Nottingham Univ., Engl. £0.50

A package is described which enables the simulation of simple random samples from a variety of standard discrete and continuous distributions and, more generally, from any distributions for which distribution functions are provided. With the advent of modern electronic computers leading to the development of investigation techniques, simulation techniques have become an increasingly important tool. Such a package is a basic requirement of computer software for the simulation experimenter.
Author (ESRO)

N73-10588# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
THE ARL LINEAR ALGEBRA LIBRARY
Paul J. Nikolai Aug. 1971 71 p refs
(AF Proj. 7071)
(AD-745430; ARL-71-0137) Avail: NTIS CSCL 09/2

The purpose of the report is to present a comprehensive description of a library of numerical linear algebra programs written in the FORTRAN language. Sufficient mathematical background is provided to enable the knowledgeable non-specialist to use the programs to solve a variety of problems in science or engineering which depend on the rapid, accurate solution of linear systems or the determination of eigenvalues and eigenvectors of real symmetric matrices. In order to acquire a listing, card deck, or magnetic tape copy of the library, write directly to the author. Author (GRA)

N73-10589# Naval Postgraduate School, Monterey, Calif.
A FORTRAN PROGRAM TO SOLVE THE STEADY STATE MATRIX RICCATI EQUATION OF OPTIMAL CONTROL M.S. Thesis
Donald Edward Heath Jun. 1972 42 p refs
(AD-745862) Avail: NTIS CSCL 12/1

The thesis presents a FORTRAN program that numerically solves the steady-state matrix Riccati equation of the quadratic cost optimal control problem. Each step of the program is presented, analytically and computationally. The check points incorporated in the program and the input parameters that can be used to assure a correct solution are identified and discussed. Difficulties encountered when verifying the program, and the suggested solutions, are also presented. Author (GRA)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N73-10590 National Lending Library for Science and Technology, Boston Spa (England).
INTRODUCTION TO THE NONLINEAR THEORY OF MESOMETEOROLOGICAL PROCESSES
L. N. Gutman [1972] 247 p refs Transl. into ENGLISH of Russian publ., Leningrad, Gidrometizdat, 1969 p 3-385.
(NLL-M-20716-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 25 NLL photocopy coupons

Existing theories and data on nonlinear mesometeorology are discussed and systematized. Analytical solutions of the steady state problems and numerical solutions of the steady state problems and numerical solutions of the nonstationary problems are presented. Thermohydrodynamic equations of mesometeorological processes are developed, and the effect of uneven terrain on the air currents is discussed in detail. Fronts, thermals, cumulus clouds, whirlwinds and tornadoes, and local winds are also considered. N.E.N.

N73-10591 National Lending Library for Science and Technology, Boston Spa (England).
THE PROCESSING OF OPERATIONAL METEOROLOGICAL INFORMATION WITH THE AID OF ELECTRONIC COMPUTERS
S. L. Belousov, L. G. Gandin, and S. A. Maskovic [1972] 302 p refs Transl. into ENGLISH of Russian publ., Leningrad, Gidrometeoizdat, 1968 p 282 No diagrams etc.; to be used in conjunction with original paper
(NLL-M-20789-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 30 NLL photocopy coupons

The theoretical and practical results of automatic data processing in the meteorological service are generalized in terms of the development of numerical forecasting. The requirements for computer techniques in handling the large volume of routine observational data are discussed. F.O.S.

N73-10592 National Lending Library for Science and Technology, Boston Spa (England).
LONG TERM VARIATIONS OF THE ATMOSPHERIC CIRCULATION AND LONG-RANGE HYDROMETEOROLOGICAL FORECASTING
A. A. Girs [1972] 271 p refs Transl. into ENGLISH of Russian book, Leningrad, Gidromet. Izdat, No diagrams etc.; to be used in conjuction with original book
(NLL-M-22333-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 27 NLL photocopy coupons

Long-term tendencies in atmospheric circulation with different time scales are discussed for the development of methods of long-range hydrometeorological forecasts. The forms of atmospheric circulation and their basic characteristics in the Northern Hemisphere are described, along with long-term fluctuations of circulation forms and epochs. Long-term variations in surface air pressure, position and intensity of centers of action, air temperature, precipitation, and climate variations are considered in detail. Special features of the long-term variations of the hydrosphere and their connection with the atmospheric circulation are also discussed. The causes of formation of epochs in the development of atmospheric circulation are reviewed, as are the interrelationship of different stages of circulation development for hydrometeorological forecasting. Solar activity and hydrostatic index forecasts are used to develop a prediction of the next epoch. N.E.N.

N73-10593 National Lending Library for Science and Technology, Boston Spa (England).
THE DYNAMICS OF THE ATMOSPHERIC BOUNDARY LAYER
S. S. Zilitinkevich [1972] 241 p refs Transl. into ENGLISH of Russian book, Leningrad, 1970 No diagrams etc.; to be

used in conjunction with original paper
(NLL-M-22574-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 24 NLL photocopy coupons

The atmospheric boundary layer in a stratified rotating fluid is considered from the hydrodynamic view point. The effects of static stability forces and the coriolis force are the important features. Micrometeorological processes over a flat homogeneous underlying surface are emphasized, and the main application is the determination of eddy shear stresses and vertical eddy heat and moisture fluxes. Similarity and semi-empirical theories are described for the surface layer of the atmosphere, and methods are given for calculating eddy fluxes from gradient observations. The planetary boundary layer away from the equator, sometimes called the Ekman layer, is discussed in detail. Theoretical models are given for the steady state and nonstationary boundary layers. N.E.N.

N73-10594 National Lending Library for Science and Technology, Boston Spa (England).
METEOROLOGICAL PARAMETERS OF THE STRATOSPHERE
K. T. Logvinov [1972] 180 p refs Transl. into ENGLISH of Gidromet. Inst., Kiev, book, 1970
(NLL-M-22213-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 20 NLL photocopy coupons

A detailed aeroclimatogical study of the distinguishing characteristics of the distributions in space of stratospheric features is presented, based on rocketsonde data for the Northern Hemisphere over the period 1957 through 1964. Temperature, pressure, and wind fields in the stratosphere are studied, along with their annual variations. An attempt is made to use the data to draw charts of the distributions of various elements over the hemisphere which will make possible some assessment of the distributions. The sparseness of the rocket observations results in tentative conclusions, especially for 45 km altitude and above. N.E.N.

N73-10595 National Lending Library for Science and Technology, Boston Spa (England).
NUMERICAL METHODS IN WEATHER FORECASTING, VOLUME 1
G. I. Marchuk 22 Mar. 1971 120 p refs Transl. into ENGLISH from Acad. Sci. USSR publ., Leningrad, 1967
(NLL-M-20352-(5828.4F)-Vol-1) Avail: Natl Lending Library, Boston Spa, Engl.: 12 NLL photocopy coupons

The application of computational mathematics to the solution of problems of dynamic meteorology and weather forecasting is discussed. Algorithms are described for the numerical solution of meteorological problems, based on a method of breaking down the equations of dynamic atmospheric processes. The basic equations, quasi-geostrophic approximation, atmospheric and weather forecasting models, and principles of constructing global numerical forecasting models are discussed. N.E.N.

N73-10596 National Lending Library for Science and Technology, Boston Spa (England).
NUMERICAL METHODS IN WEATHER FORECASTING, VOLUME 2
G. I. Marchuk 22 Mar. 1971 215 p Transl. into ENGLISH from Acad. Sci. USSR publ., Leningrad, 1967
(NLL-M-20352-(5828.4F)-Vol-2) Avail: Natl. Lending Library, Boston Spa, Engl.: 21 NLL photocopy coupons
For abstract, see N73-10595.

N73-10597 National Lending Library for Science and Technology, Boston Spa (England).
VARIATIONS OF CLIMATE
M. I. Budyko 17 Nov. 1970 39 p refs Transl. into ENGLISH of the publ. "Izmereniya Klimaka" Leningrad, Gidrometeoizdat, 1969
(NLL-M-20071-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 4 NLL photocopy coupons

Past, present, and projected climatic conditions are discussed. The influence of solar radiation in the atmosphere and hydrosphere, and modifications caused by it are considered. The emphasis is on climatic changes, Quaternary glaciations, pre-Quaternary climate, and the possible natural and man-induced changes in the climate. N.E.N.

N73-10598 National Lending Library for Science and Technology, Boston Spa (England).
GRAPHICAL AND ANALYTICAL METHODS FOR CALCULATING THE PROBABILITIES OF RARE METEOROLOGICAL PHENOMENA
L. B. Garcman and M. V. Zavarina [1972] 7 p Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 265, 1970 p 88-95
(NLL-M-22672-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl: 1 NLL photocopy coupon

Equations are developed for the construction of nomograms of occurrences of rare meteorological phenomena for the use of engineers in constructing structures. Examples are given for high wind speeds, glaze, and rime. N.E.N.

N73-10599 National Lending Library for Science and Technology, Boston Spa (England).
METEORS ON WATCH: SCIENCE EXTENDS ITS VISTAS
I. Andronov [1972] 5 p Transl. into ENGLISH from Pravda (USSR), 25 May 1972
(NLL-M-22683-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The Soviet Meteor meteorological space system is described and its capabilities in the fields of weather forecasting, geological surveying, and exploration of earth resources are briefly outlined. A.L.

N73-10600*# San Jose State Coll., Calif. Dept. of Meteorology.
WEATHER FORECASTS, USERS' ECONOMIC EXPENSES AND DECISION STRATEGIES
Gary M. Carter Jun. 1972 60 p refs
(Grant NGR-05-046-005)
(NASA-CR-128401) Avail: NTIS HC $5.00 CSCL 04B

Differing decision models and operational characteristics affecting the economic expenses (i.e., the costs of protection and losses suffered if no protective measures have been taken) associated with the use of predictive weather information have been examined. Author

N73-10601# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, OCTOBER 1971
1972 309 p refs
Avail: NTIS HC $17.50

Daily upper air data, corrected for temperature error and curvature of the earth, are presented for Japan and its vicinity. The tables include standard pressure levels, temperature and humidity levels, wind levels, pilot-balloon data, and rocketsonde data. Author

N73-10602# Secretariat General a l'Aviation Civile, Paris (France).
WIND ALTITUDE OVER FRENCH POLYNESIA [LE VENT EN ALTITUDE AU-DESSUS DE LA POLYNESIE FRANCAISE]
A. dHauteserre Apr. 1972 58 p refs In FRENCH
(MN-Mono-85) Avail: NTIS HC $5.00

Tables and graphs on wind altitude over French Polynesia are presented. Data cover wind velocity profiles and stratospheric and tropospheric circulation. Transl. by E.H.W.

N73-10603# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, 1971. APPENDIX: ATMOSPHERIC OZONE DATA FOR JANUARY - DECEMBER 1971
1972 333 p
Avail: NTIS HC $18.75

Daily upper air data, corrected for temperature error and curvature of the earth, are presented for Japan and its vicinity. The tables include standard pressure levels, temperature and humidity levels, wind levels, pilot-balloon data, and rocketsonde data. Atmospheric ozone data are included. Author

N73-10604# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, NOVEMBER 1971
1972 301 p
Avail: NTIS HC $17.25

Daily upper air data, corrected for temperature error and curvature of the earth, are presented for Japan and its vicinity.

The tables include standard pressure levels, temperature and humidity levels, wind levels, pilot-balloon data, and rocketsonde data. Author

N73-10605# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN: FIVE-YEAR PERIOD AVERAGES, 1966 - 1970
Nov. 1972 192 p
Avail: NTIS HC $11.75

Daily upper air data, corrected for temperature error and curvature of the earth, are presented for Japan and its vicinity. The tables include standard pressure levels, temperature and humidity levels, wind levels, pilot-balloon data, and rocketsonde data. Author

N73-10606# Bureau of Meteorology, Melbourne (Australia).
MONTHLY CLIMATE DATA, UPPER AIR AUSTRALIA, DECEMBER 1971
Dec. 1971 18 p
Avail: NTIS HC $3.00

Monthly mean meteorological statistics for specified pressure levels from the surface to 5 mb for December 1971 are tabulated. The statistics include geopotential, atmospheric temperature, humidity (mixing ratios), and wind direction and speed. Author

N73-10607# Bureau of Meteorology, Melbourne (Australia).
MONTHLY CLIMATE DATA, UPPER AIR AUSTRALIA, AUGUST 1971
Aug. 1971 18 p
Avail: NTIS HC $3.00

Monthly mean meteorological statistics for specified pressure levels from the surface to 5 mb for August 1971 are tabulated. The statistics include geopotential, atmospheric temperature, humidity (mixing ratios), and wind direction and speed. Author

N73-10608# Bureau of Meteorology, Melbourne (Australia).
FREQUENCIES, TRACKS AND INTENSITIES OF TROPICAL CYCLONES IN THE AUSTRALIAN REGION 1909 TO 1969
F. Coleman Jul. 1972 101 p refs
Avail: NTIS HC $7.25

Statistical data of tropical cyclones in the Australian Region east of the 135 E meridian from November 1909 to June 1969 and west of the 135 E meridian from November 1919 to June 1969 are investigated, and facts illustrating the behaviour of past tropical cyclones are presented. Monthly frequencies of tropical cyclones for the season November to June, in decades, are tabulated for the two regions and also for sections of the Australian coast. Maps of tracks for the months of December to April, in decades, and maps of average frequency of tropical cyclones crossing 5-degree latitude-longitude squares per 10 years for the months December to April are presented. The frequency of centers of tropical cyclones endangering the coast and passing within 30, 60 and 90 nautical miles of places named are tabulated. Author

N73-10609# Bureau of Meteorology, Melbourne (Australia).
PRECIPITABLE WATER STATISTICS, AUSTRALIA MONTHLY STATISTICS OF PRECIPITABLE WATER BETWEEN SURFACE AND 400 MB AT 2300 GMT, 1958 - 1969
C. L. Pierrehumbert Mar. 1972 75 p refs
Avail: NTIS HC $5.75

Values of precipitable water are estimated from daily radiosonde ascents at 33 stations in the Australian region. The method of estimation and the observational limits are discussed. Because the radiosonde equipment currently used is not capable of accurate measurement of very low humidities, two estimates of precipitable water were made for each flight. The estimates of precipitable water are treated on a monthly basis and the normality of the distributions is investigated. Percentile values, means, extremes, skewness, and excess of kurtosis are tabulated for each month at each station. Author

N73-10610*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CALCULATION OF IRROTATIONAL WIND PATTERN WITH APPLICATION TO CLEVELAND TOPOGRAPHY
Robert Siegel Washington Oct. 1972 26 p refs
(NASA-TM-X-2653; E-7039) Avail: NTIS HC $3.00 CSCL 04/2

Small perturbation theory is applied to compute the deflection of the wind blowing across land that has an irregular topography. As an illustration, the method is applied first to the flow around a single hill of Gaussian profile. Then calculations are made for the irregular topography on the east side of Cleveland where the elevation changes by several hundred feet. It was found that the topography produced small wind deflections that would not be of practical importance in air pollution dispersion studies. The calculations were for a neutrally stable atmosphere. Although they are not investigated here, other factors such as thermal stratification of the atmosphere, diurnal variations, and convection currents resulting from the proximity of Lake Erie and the city heat island effect are expected to be more significant than the influence of topography. Author

N73-10611# National Environmental Satellite Service, Washington, D.C.
CLOUD MOTIONS IN BAROCLINIC ZONES
Linwood F. Whitney, Jr. Oct. 1972 8 p refs
(NOAA-TM-NESS-43) Avail: NTIS HC $3.00

For some time, an uncertainty has existed concerning the height of clouds used to derive cloud motions in baroclinic zones. As a result there is a ban on the operational use and dissemination of cloud vectors derived in these areas. Baroclinic cloud motions are investigated by comparing a sample of such motions with rawinsonde data. Collectively, the vectors agree best with the winds at 14,000 to 16,000 ft. Author

N73-10612*# New York Univ., N.Y. Geophysical Sciences Lab.
EFFECTS OF SURFACE ANOMALIES ON CERTAIN MODEL GENERATED METEOROLOGICAL HISTORIES
Jerome Spar Apr. 1972 58 p refs
(Grant NGR-33-016-174)
(NASA-CR-130070; GSL-TR-72-2) Avail: NTIS HC $5.00 CSCL 04/2

The Mintz-Arakawa 2-level general circulation model has been used in a series of experiments to compute the response of the model atmosphere to: (1) a positive sea surface temperature anomaly in the North Pacific Ocean in summer and in winter, (2) an identical anomaly in the South Pacific Ocean in the Southern Hemisphere winter, and (3) anomalous northward and southward displacements of the Northern Hemisphere snow line over the continents. In each case computations were carried out for 90 forecast days. Results are shown in terms of the differences between anomaly and control histories. Time series of certain regional response indices, including area-average sea level pressure and 600 mb circulation indices, as well as 30-day mean sea level pressure maps are used in the analysis. Of particular interest is the evidence of significant interhemisphere influence. Author

N73-10613# National Meteorological Center, Washington, D.C.
UPDATING ASYNOPTIC DATA FOR USE IN OBJECTIVE ANALYSES
Armand J. Desmarais Oct. 1972 20 p refs
(NOAA-TM-NWS-NMC-51) Avail: NTIS HC $3.00

Case studies are used to evaluate methods for updating asynoptic meteorological observations to a synoptic time for possible use in operational objective analyses. Selected radiosonde height and temperature data from the data-rich area over the United States are updated for 12-hour periods with tendency and advective methods. Persistence of 12-hour old observations is also considered. Overall results for eleven cases indicate that the tendency method exhibits smaller root-mean-square errors for the 12-hour updates than those obtained by advective methods or persistence as verified against operational analyses. Author

N73-10614*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PRECIPITATION CRITERIA GUIDELINES FOR USE IN AEROSPACE VEHICLE DEVELOPMENT
Glenn E. Daniels 22 Mar. 1972 41 p refs
(NASA-TM-X-64650) Avail: NTIS HC $4.25 CSCL 04B

Guidelines are provided on probable precipitation extremes and characteristics applicable for NASA space vehicles and associated equipment development. Information is provided on

probability of rainfall rates, drop size, drop rate of fall, associated wind speeds with rainfall, snow loads, hail, laboratory test simulation, and rain erosion. Author

N73-10615*# National Aeronautics and Space Administration, Washington, D.C.
PHOTOGRAPHIC METROLOGY
Yu. N. Gorokhovskiy Nov. 1972 21 p refs Transl. into ENGLISH from Usp. Nauchn. Fotogr., Akad. Nauk SSSR, Otd. Khim. Nauk (Moscow), v. 15, 1970 p 183-195
(NASA-TT-F-13921) Avail: NTIS HC $3.25 CSCL 04B

Soviet scientific research into the subject of photographic metrology is reviewed and discussed. Photographic metrology is the study of standards and accurate measurements in the field of photographic science and technology. A.L.

N73-10616*# National Aeronautics and Space Administration, Washington, D.C.
SATELLITE METEOROLOGY Table of Contents, Figure and Table Titles
K. S. Shifrin, ed. and V. L. Gayevskiy, ed Jun. 1972 14 p Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 221, 1968
(NASA-TT-F-14447) Avail: NTIS HC $3.00 CSCL 04B

An index of information collected by Soviet weather satellites is presented. The tabulated data and figures are grouped into types, and include: statistical characteristics of signals received from a scanning infrared apparatus, data processing, utilization of data, problems of interpreting infrared images of clouds, probability of observing clouds, and spectral brightness of clouds and objects on the landscape. F.O.S.

N73-10617*# Northrop Services, Inc., Huntsville, Ala.
RUNWAY CROSSWINDS AND HEADWIND REVERSALS AT CAPE KENNEDY, FLORIDA
L. G. Lavdas Oct. 1972 51 p refs
(Contract NAS8-21810)
(NASA-CR-128995) Avail: NTIS HC $4.75 CSCL 04B

Ground level hourly peak-wind data at Cape Kennedy have been used to determine an optimal runway orientation for minimizing the frequency of critically high crosswinds. The optimum runway orientation has been found to be close to the 155 to 335 degree orientation of the proposed runway for the range of critical crosswinds considered. This proposed runway orientation was used in determining the frequency of one hour headwind to tailwind reversals resulting in critically high tailwind speeds from ground level hourly peak wind data. These reversal frequencies have been calculated for each hour period within each month. The overall frequency of a headwind to tailwind reversal of any magnitude has been found to be just under ten percent. Considerable diurnal and monthly variations in the frequencies of reversal have been found. Errors in both the crosswind and reversal studies have arisen from computational and statistical imperfections. The nonrepresentativeness of surface hourly peak wind data as related to the problems associated with the landing operations of the space shuttle has been duly noted. Author

N73-10618# Institut Royal Meteorologique de Belgique, Brussels.
CLIMATOLOGICAL OBSERVATIONS Monthly Bulletin, Jul. 1972 [OBSERVATIONS CLIMATOLOGIQUES BULLETIN MENSUEL, JUILLET 1972]
R. Sneyers 4 Aug. 1972 16 p In FRENCH and DUTCH
Avail: NTIS HC $3.00

Meteorological parameters observed at different Belgian weather stations during June 1970 are given. ESRO

N73-10619# Institut Royal Meteorologique de Belgique, Brussels.
ATMOSPHERIC POLLUTION, SMOKE, AND SULFUR DIOXIDE Monthly Bulletin, Oct. 1971 [POLLUTION ATMOSPHERIQUE, FUMEE ET ANHYDRIDE SULFUREUX BULLETIN MENSUEL, OCTOBRE 1971]
Oct. 1971 28 p In FRENCH and DUTCH Prepared jointly with Inst. d'Hyg. et d'Epidemiol.
Avail: NTIS HC $3.50

Data obtained at Belgian weather stations are tabulated. The air pollution apparatus is briefly described. ESRO

N73-10620# European Southern Observatory, Hamburg (West Germany).
METEOROLOGICAL OBSERVATIONS ON LA SILLA IN 1970
B. E. Westerlund Jul. 1972 19 p
(ESO-Bull-9) Avail: NTIS HC $3.00

Tables of values are given for the following meteorological parameters: cloud cover, wind velocity, wind direction, temperature, and humidity. The observations were carried out at La Silla Observatory, Chile, during 1970. Author (ESRO)

N73-10621# Scripps Institution of Oceanography, La Jolla, Calif.
LARGE-SCALE AND LONG-TERM FLUCTUATIONS IN SOME ATMOSPHERIC AND OCEANIC VARIABLES
Jerome Namias 1972 47 p refs
(Contract N00014-69-A-0200-6006)
(AD-744976) Avail: NTIS CSCL 04/2

When meteorological variables are averaged over periods of days, weeks, months, seasons, years or decades and the averages plotted on charts, a special class of macroscale phenomena come to light. Whatever the period of averaging, there are significant departures from longer term means such as climatological normals. The eternally anomalous character of components of the atmosphere's general circulation provides mechanisms for altering the thermal characteristics of the upper layer of the ocean. These alterations, in turn, appear to force abnormalities of wind, weather, and temperature patterns in the overlying atmosphere, largely through variable heating. This paper describes the nature of these atmospheric and oceanic anomalies mainly from observations gathered in the last quarter century, and it suggests some causal linkages. Author (GRA)

N73-10622# Delaware Univ., Newark. Coll. of Marine Studies.
ON THE DISA 55D15 LINEARIZER
Francis J. Merceret Jun. 1972 18 p
(Contract N00014-69-A-0407)
(AD-744975; CMS-2MS070; TR-11) Avail: NTIS CSCL 04/2

During the course of an investigation using hot-film anemometry, the author noted that DISA 55D15 linearizers performed in a manner inconsistent with his expectations after carefully reading the instruction manual for the units. Subsequent investigation revealed an error in the transfer function of the linearizer as it is presented in the manual; the correct function was obtained from consideration of the circuitry. The new function as derived was tested experimentally and found adequate. In addition, an explanation for the observed insensitivity of the calibration of 55D15-linearized hot-sensor systems to overheat ratio is derived. Author (GRA)

N73-10623# Air Weather Service, Scott AFB, Ill.
AIRCRAFT ICING CLIMATOLOGY FOR THE NORTHERN HEMISPHERE
Edward D. Heath and Luther M. Cantrell Jun. 1972 76 p refs
(AD-745098; AWS-TS-220) Avail: NTIS CSCL 04/2

The report is an update of the methodology used within the Air Weather Service to determine the climatological probability of aircraft icing throughout the Northern Hemisphere. It presents isopleth charts of the 1000-, 850-, 700-, and 500-mb surfaces for each of the twelve months. A station listing and locator chart gives the extensive areal coverage of the data used in the computerized calculations. Author (GRA)

N73-10624# Naval Postgraduate School, Monterey, Calif. Dept. of Meteorology.
REGRESSION RELATIONSHIPS BETWEEN SATELLITE INFRARED RADIANCES AND GEOPOTENTIAL HEIGHTS OF THE 500 mb AND 300 mb LEVELS M.S. Thesis
Robert Alan Stanfield Mar. 1972 60 p refs
(AD-743711) Avail: NTIS CSCL 04/2

Least squares methods are used with NIMBUS 4 SIRS-B clear-column radiances as independent variables and two identical-period sources of geopotential heights (at the 500 mb and 300 mb pressure levels) as dependent variables. Regression equations are developed for each of the sets of geopotential heights for three latitude bands in the Northern Hemisphere. Three-day and four-day data bases were used on each regression specification. Each set of equations was tested on independent data at a subsequent composite period of 12-hours and 24-hours

following the dependent pooled samples. The regression results of both the dependent and independent tests were examined for possible operational usefulness. Author (GRA)

N73-10625# Naval Postgraduate School, Monterey, Calif. Dept. of Meteorology.
NUMERICAL-STATISTICAL PREDICTION OF VISIBILITY AT SEA M.S. Thesis
Thomas Swan Nelson Mar. 1972 36 p refs
(AD-743733) Avail: NTIS CSCL 04/2

Visibility is one of the most important weather elements in marine navigation. It is commonly believed that the primary factors determining visibility are the wind speed and the relative moisture content of the air. Using regression analysis, an attempt is made to establish a linear functional relationship between observed visibility and objectively-determined parameters from conventional marine surface observations. Forecast visibilities are obtained from derived regression equations using elements available from a numerical primitive equation forecast model. Author (GRA)

N73-10626# Naval Postgraduate School, Monterey, Calif. Dept. of Meteorology.
SOME NUMERICAL ASPECTS OF DEVELOPING AN OPERATIONAL PRIMITIVE-EQUATION MODEL FOR THE TROPICS M.S. Thesis
Rodger Alfred Langland Mar. 1972 66 p refs
(AD-743729) Avail: NTIS CSCL 04/2

A barotropic primitive equation model on a global tropical grid using operational read data is used to test various boundary conditions and methods of initialization including numerical variational analysis. Comparisons of forecast accuracy are made between staggered and non-staggered grids. Author (GRA)

N73-10627# Texas A&M Univ., College Station. Dept. of Physics.
RADIATIVE TRANSFER IN THE EARTH'S ATMOSPHERE-OCEAN SYSTEM. 2: RADIANCE IN THE ATMOSPHERE AND OCEAN
George W. Kattawar and Gilbert N. Plass 8 Feb. 1972 12 p refs Repr. from J. of Phys. Oceanog., v. 2, Apr. 1972 p 146-156
(Contract N00014-68-A-0308-002; NR Proj. 083-36)
(AD-745282) Avail: NTIS CSCL 04/1

In the first part of this paper Plass and Kattawar 1972 presented a method for the calculation of the radiation field in the earth's atmosphere-ocean system. The solar photons are followed through the atmosphere and ocean by a Monte Carlo method which includes all orders of multiple scattering that make any noticeable contribution to the detectors. In the atmosphere, both Rayleigh scattering by the molecules and Mie scattering by the aerosols as well as molecular and aerosol absorption are included in the model. In the second part the upward and downward radiance is presented as a function of the nadir or zenith angle for a number of different detector locations in the atmosphere and ocean. GRA

N73-10628# RAND Corp., Santa Monica, Calif.
SUPPLEMENTAL GLOBAL CLIMATIC DATA, JANUARY
C. Schutz and W. L. Gates May 1972 46 p refs
(Contract DAHC15-67-C-0141; ARPA Order 189-1)
(AD-744633; R-915/1-ARPA) Avail: NTIS CSCL 04/2

The global distributions of the surface albedo for January, the planetary albedo for January, and the total precipitation for December, January, and February are presented as a supplement to the January data previously published (Schutz and Gates, 1971). A number of refinements of the high-latitude sea-surface temperature data have also been made, and the revised global January distribution is given. All data are presented on a global grid of 4-deg latitude and 5-deg longitude, as in the past, and are given in the form of both tabulated values and machine-analyzed maps. These data will be used as a guide in Rand's evaluation of climate simulations based on the Mintz-Arakawa general circulation model. Author (GRA)

N73-10629# Army Electronics Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
FOGWASH 1, AN EXPERIMENT USING HELICOPTER DOWNWASH
D. H. Dickson Apr. 1972 59 p refs
(DA Proj. 1T0-62111-A-126)
(AD-744471; ECOM-5431) Avail: NTIS CSCL 04/2

The report documents Project Fogwash 1, an experimental program in which the technique of helicopter downwash for fog dissipation was used. Meteorological and microphysical data collected during the experiment are presented. Meteorological data indicated an improvement in visibility as a result of the downwash. There were indications in the microphysical data obtained that particulate number varies directly as relative humidity and inversely as temperature and that sulfate particles increase with increased relative humidity. Author (GRA)

N73-10630# Naval Weather Service Command, Washington, D.C.
ATLANTIC TROPICAL CYCLONE STRIKE PROBABILITIES. VOLUME 1: 24 HOUR MOVEMENT
Harold L. Crutcher (Natl. Climatic Center) and Frank T. Quinlan (Natl. Climatic Center) Aug. 1971 66 p refs
(AD-744916) Avail: NTIS CSCL 04/2

Probabilities relating to the future movement of North Atlantic tropical cyclones are presented. The probabilities are based on observational data of successive 12-hour positions of the centers of these storms. The data are stratified into five seasons (June-July, August, September, October, November-May) and into geographical areas defined by five-degree latitude-longitude squares. The probabilities are computed assuming the initial storm position or origin is always at the center of the square and the target areas are always circular areas with radii of one, two and three degrees latitude which are also located at the center of the squares. These probabilities indicate the chance of the storm center being within the target areas at the end of specified time intervals. Two sets of probabilities are presented for each square: one set for the case when the origin is at the center of the master square, and a second set for the case where the target areas are centered on this square. Values for time intervals of 24 hours, are presented in Volume I. Author (GRA)

N73-10631# Naval Weather Service Command, Washington, D.C.
ATLANTIC TROPICAL CYCLONE STRIKE PROBABILITIES. VOLUME 2: 48 HOUR MOVEMENT
Harold L. Crutcher (Natl. Climatic Center) and Frank T. Quinlan (Natl. Climatic Center) Aug. 1972 100 p refs
(AD-744917) Avail: NTIS CSCL 04/2

Probabilities relating to the future movement of North Atlantic tropical cyclones are presented. The probabilities are based on observational data of successive 12-hour positions of the centers of these storms. The data are stratified into five seasons (June-July, August, September, October, November-May) and into geographical areas defined by five-degree latitude-longitude squares. The probabilities are computed assuming the initial storm position or origin is always at the center of the square and the target areas are always circular areas with radii of one, two and three degrees latitude which are also located at the center of the squares. These probabilities indicate the change of the storm center being within the target areas at the end of specified time intervals. Two sets of probabilities are presented for each square: one set for the case when the origin is at the center of the master square, and a second set for the case where the target areas are centered on this square. Values for time intervals of 48 hours are presented in Volume II. Author (GRA)

N73-10632# Naval Weather Service Command, Washington, D.C.
ATLANTIC TROPICAL CYCLONE STRIKE PROBABILITIES. VOLUME 3: 72 HOUR MOVEMENT
Harold L. Crutcher (Natl. Climatic Center) and Frank T. Quinlan (Natl. Climatic Center) Aug. 1971 124 p refs
(AD-744918) Avail: NTIS CSCL 04/2

Probabilities relating to the future movement of North Atlantic tropical cyclones are presented. The probabilities are based on observation data of successive 12-hour positions of the centers of these storms. The data are stratified into five seasons (June-July, August, September, October, November-May) and into geographical areas defined by five-degree latitude-longitude squares. The

probabilities are computed assuming the initial storm position or origin is always at the center of the square and the target areas are always circular areas with radii of one, two and three degrees latitude which are also located at the center of the squares. These probabilities indicate the chance of the storm center being within the target areas at the end of specified time intervals. Two sets of probabilities are presented for each square: one set for the case when the origin is at the center of the master square, and a second set for the case where the target areas are centered on this square. Values for time intervals of 72 hours are presented in Volume III. Author (GRA)

N73-10633# Naval Postgraduate School, Monterey, Calif.
OPERATIONAL UTILIZATION OF WEATHER SATELLITE DATA FOR INPUT TO NUMERICAL ANALYSIS AND PREDICTION M.S. Thesis
Lewis Eugene Zeigler Mar. 1972 75 p refs
(AD-745173) Avail: NTIS CSCL 04/2

The results of techniques and procedures used to evaluate the utility of satellite observations for enhancing the accuracy and detail of numerical analyses in sparse-data areas are presented. The experiments employed statistically-derived and subjective interpretations from video and infrared satellite data, for the purpose of modifying Fleet Numerical Weather Central's operational surface, 500- and 300-mb analyses. The resulting satellite-modified analyses for six synoptic times, in the period 11-14 March 1971, presents an implementation of satellite input to numerical analyses and prediction. The technology demonstrated here is offered as a guide to the man-machine approach to extratropical analysis as performed by major numerical weather centers. Author (GRA)

N73-10634# American Inst. of Crop Ecology, Silver Spring, Md.
AICE SURVEY OF USSR AIR POLLUTION LITERATURE. VOLUME 12: TECHNICAL PAPERS FROM THE LENINGRAD INTERNATIONAL SYPOSIUM ON THE METEOROLOGICAL ASPECTS OF ATMOSPHERIC POLLUTION, PART 1
M. Y. Nuttonson Jan. 1972 139 p refs Symp. held at Leningard, Jul. 1968
(PB-210381; AICE-AIR-72-12; APTD-1117-Vol-12-Pt-1) Avail: NTIS CSCL 13B

Twelve papers dealing with the meteorological aspects of air pollution were translated. These papers were initially presented at an international symposium held in Leningrad during July 1968. Author

N73-10635# Stanford Research Inst., Menlo Park, Calif.
ATMOSPHERIC MEASUREMENT OF PHOTOCHEMICAL SMOG REACTIONS: A PRELIMINARY ANALYSIS Final Report
R. C. Robbins and L. A. Cavanagh Feb. 1972 60 p refs
(Contract EPA-68-02-0010)
(PB-210422; CRC-APRAC-CAPA-7-70-12) Avail: NTIS HC $3.00 CSCL 13B

The research was a brief feasibility study and field measurement program to determine whether the San Francisco Bay area might provide meteorological and photochemical smog patterns that were conducive to field research on smog reaction processes. It was concluded from both climatological and field oxidant sampling that this was the situation if atmospheric data could be gathered over the waters of the bay, particularly east and south of San Francisco. Author (GRA)

N73-10636# Stanford Research Inst., Menlo Park, Calif.
REGIONAL AIR POLLUTION STUDY: A PROSPECTUS. PART 1: SUMMARY Final Report
Jan. 1972 102 p
(Contract EPA-68-02-0207; SRI Proj. 1365)
(PB-210017; APTD-1122-Pt-1) Avail: NTIS HC $5.45 CSCL 13B

The problem of effectively managing air quality within the framework of current legislation on a regional basis is extensive and complex. The need to evaluate and improve control strategies already adopted or to identify new approaches must be considered on this basis. By effectively coordinating efforts on a number of interrelated problems, a combination of resources can be brought to bear on the problems of air quality management. It is the purpose of the Prospectus to identify the separate elements constituting such an undertaking and to describe how it can be carried out. The major concept of RAPS (regional air pollution study) is presented, with an outline description of the research plan, the facility, and the management plan (which includes budgetary information). GRA

N73-10637# Stanford Research Inst., Menlo Park, Calif.
REGIONAL AIR POLLUTION STUDY: A PROSPECTUS. PART 2: RESEARCH PLAN Final Report
Jan. 1972 280 p refs
(Contract EPA-68-02-0207; SRI Proj. 1365)
(PB-210018; APTD-1123-Pt-2) Avail: NTIS HC $6.75 CSCL 13B

The report describes the research plan to be used in the regional air pollution study which is being developed to aid in improving and controlling regional air quality. A comprehensive overview is provided of the three principal components contained in the process of air pollution: meteorological processes; atmospheric chemistry and transformation processes; and the emissions sources. The specific research tasks to be carried out are defined. The contents include: overview of air pollution modeling; meteorological processes; atmospheric chemistry and transformation processes; emission estimates; economic and social impact studies; and technology transfer. GRA

N73-10638# Stanford Research Inst., Menlo Park, Calif.
REGIONAL AIR POLLUTION STUDY: A PROSPECTUS. PART 3: RESEARCH FACILITY Final Report
Jan. 1972 187 p refs
(Contract EPA-68-02-0207; SRI Proj. 1365)
(PB-210019; APTD-1124-Pt-3) Avail: NTIS HC $6.00 CSCL 13B

The conceptual definition and detailed discussion of the permanent instrument, data handling and processing facility planned for the regional air pollution study are presented. The facility, by its design and mode of operation, is intended to provide the basic support to the research efforts. The St. Louis, Missouri facility is conceived as consisting of a system of air quality and meteorological instrument stations established within an area roughly enclosed by a circle of 100-km radium with the St. Louis arch as its center. A central support facility is also planned, which includes data handling and processing equipment, office and laboratory space, and repair and maintenance shops. Author (GRA)

N73-10639# Stanford Research Inst., Menlo Park, Calif.
REGIONAL AIR POLLUTION STUDY: A PROSPECTUS. PART 4: MANAGEMENT PLAN Final Report
Jan. 1972 174 p
(Contract EPA-68-02-0207; SRI Proj. 1365)
(PB-210020; APTD-1125-Pt-4) Avail: NTIS HC $6.00 CSCL 13B

Findings largely applicable to the scheduling, management and staffing, and the estimated costs of the St. Louis regional air pollution study facility are presented. The planning factors are regarded as having an accuracy and reliability suitable for planning purposes and for the purpose of providing a working format for additional and more detailed planning efforts. The contents include: implementation schedule of the St. Louis facility; permanent management and staffing; St. Louis facility initial costs, and annual operating costs; and research plan costs. Author (GRA)

N73-10640# RAND Corp., Santa Monica, Calif.
ANALYSIS OF THE MEAN FORCING FIELDS SIMULATED BY THE TWO-LEVEL MINTZ-ARAKAWA ATMOSPHERIC MODEL
W. L. Gates May 1972 51 p refs
(Contract DAHC15-67-C-0141; ARPA Order 189-1)
(AD-745752; R-958-ARPA) Avail: NTIS CSCL 04/2

The global distributions of the mean January surface wind stress, the net diabatic heating rate, and the net rate of moisture addition as simulated in a 30-day integration with the two-level Mintz-Arakawa atmospheric general circulation model are presented. The latitudinal distributions of the zonal averages of these forcing fields are shown to be in reasonable agreement with the available observations. The most prominent discrepancies

are evidently due to the model's simulation of excessive convective precipitation (and the associated convective latent heating) in the tropics, especially in the Northern (winter) Hemisphere. The zone of simulated tropical precipitation extends some 15 degrees poleward of the observed position, and results in a corresponding distortion of the field of evaporation minus precipitation (or moisture-addition rate). Author (GRA)

N73-10641# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
ATMOSPHERIC TURBULENCE FIELD PARAMETERS DETERMINATION Final Report
Robert L. Neulieb, Jan N. Garrison, and Dennis J. Golden Apr. 1972 52 p refs
(AF Proj. 1367)
(AD-745946; AFFDL-TR-72-57) Avail: NTIS CSCL 04/1

A Newton-Raphson least squares percentage error method is developed for the determination of atmospheric turbulence field parameters. A correction function is proposed to deemphasize the effects of data points with low statistical confidence. The method is used on various sets of LO-LOCAT data to demonstrate the excellence of the curve fits obtained. Comparisons are made with other curve fits found in the literature. It is recommended that this method be adopted as the standard method for the determination of atmospheric turbulence field parameters. Author (GRA)

N73-10642# American Inst. of Crop Ecology, Silver Spring, Md.
AICE SURVEY OF USSR AIR POLLUTION LITERATURE. VOLUME 11: A SECOND COMPILATION OF TECHNICAL REPORTS ON THE BIOLOGICAL EFFECTS AND THE PUBLIC HEALTH ASPECTS OF ATMOSPHERIC POLLUTANTS
M. Y. Nuttonson Jan. 1972 154 p refs
(Grant EPA-1-ROI-AP00786-APC)
(PB-209478; APTD-1067-Vol-11) Avail: NTIS HC $3.00 CSCL 13B

The contents include the following: Maximum permissible concentrations of noxious substances in the atmospheric air of populated areas; Basic problems of sanitary protection and of atmospheric air; Combined effect of hydrogen fluoride on sulfur dioxide on the body of man and animals; New data for the validation of the mean daily maximum permissible concentration of hydrogen fluoride in air; Sanitary evaluation of fluorides readily soluble in biological media; Biological effect of poorly soluble fluorides; Material for standardization of the maximum permissible concentration of hydrogen fluoride in populated areas; and Reflex effect on the human organism of low concentrations of acetic acid and acetic anhydride. Author (GRA)

N73-10643# Systems Science and Software, La Jolla, Calif.
A PARTICLE-IN-CELL METHOD FOR NUMERICAL SOLUTION OF THE ATMOSPHERIC DIFFUSION EQUATION, AND APPLICATIONS TO AIR POLLUTION PROBLEMS, VOLUME 1 Final Report
R. C. Sklarew, A. J. Fabrick, and J. E. Prager Nov. 1971 173 p refs
(Contract DI-68-02-0006)
(PB-209290; Rept-3SR-844-Vol-1; APTD-0952) Avail: NTIS HC $3.00 CSCL 13B

The method, called PICK, is based on the use of Lagrangian mass points and is one of a family of particle-in cell techniques for the solution of partial differential equations. The purpose of the study was the development of the PICK method and its demonstration in evaluation test cases and actual air pollution problems. Test cases for the evaluation of feasibility and accuracy and for comparison to finite difference solutions were conducted with a two-dimensional computer code PICFIC. For actual air pollution studies, the PICK method was used in the three dimensional code NEXUS. Author (GRA)

N73-10644# Lightning and Transients Research Inst., Minneapolis, Minn.
SMALL ROCKET WIRE DEPLOYMENT FOR LIGHTNING TRIGGERING AND HAZARD REDUCTION Final Report, Jul. 1970 - Dec. 1971
James R. Stahmann Mar. 1972 64 p refs
(Contract F19628-70-C-0273)
(AD-746309; LTRI-537; AFCRL-72-0218) Avail: NTIS CSCL 04/2

For triggering or diverting natural lightning strokes, the electrical properties of a large rocket motor and its exhaust plume were simulated by deploying long wires from small rockets. A wire length of between one and two thousand feet should adequately simulate the conductive effects of an Apollo vehicle. Various small rocket motors were considered, and the Little John was selected for study in an experimental program. The wire was deployed from an on-board package. After estimating the forces acting on the wire, a computer program for simulating a flight was developed. The experimental results gave a measure of the very difficult to estimate air drag coefficient as about three times that estimated earlier. Author (GRA)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N73-10645# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ATC SURVEILLANCE/COMMUNICATION ANALYSIS AND PLANNING Quarterly Technical Summary, 1 Jun. - 31 Aug. 1972
1 Sep. 1972 35 p refs
(Contracts F19628-70-C-0230; DOT-FA72WAI-242; Proj. 034-241-012)
(FAA-RD-72-107) Avail: NTIS HC $3.75

FAA funded ATC Surveillance/Communication Analysis and Planning activities during the period 1 June to 31 August 1972 are reported. Surveillance studies bearing upon possible courses of action to improve the performance of the present ATCRBS equipment and to equip present ARSR/ASR radars with state-of-the-art clutter reduction capability are discussed. An improved surveillance radar concept is formulated, and plans to implement this radar in a demonstration model are described. Communication studies just getting under way are outlined. Two preliminary flight tests performed to validate procedural and data reduction plans for the ATCRBS transponder switched antenna tests are described. Author

N73-10646# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SURVEILLANCE ASPECTS OF THE ADVANCED AIR TRAFFIC MANAGEMENT SYSTEM Project Report, Oct. 1971 - Jun. 1972
K. S. Schneider, I. G. Stiglitz, and A. E. Eckberg 22 Jun. 1972 219 p refs
(Contract DOT-TSC-241)
(PB-210378; ATC-10) Avail: NTIS HC $3.00 CSCL 17G

Three topics with impact on the performance of Air-to-Satellite-to-Ground Systems for Air Traffic Control Surveillance are addressed in detail: (1) vulnerability to intentional jamming, (2) performance degradation due to the multiple access noise which results from uncoordinated aircraft transmissions, and (3) tracking techniques for improved surveillance accuracy and reduced short-term outages. Author (GRA)

N73-10647# Transportation Systems Center, Cambridge, Mass.
PROPOSED CONTROL TOWER AND COCKPIT VISIBILITY READOUTS BASED ON AN AIRPORT-AIRCRAFT INFORMATION FLOW SYSTEM
Hector C. Ingrao and J. R. Lifsitz Jul. 1971 46 p refs
(AD-744718; DOT-TSC-FAA-71-18) Avail: NTIS CSCL 17/7

The problem of displaying visibility information to both controller and pilot is discussed in the context of visibility information flow in the airport-aircraft system. The optimum amount of visibility information, as well as its rate of flow and display, depends both on the needs of the pilot during landing and on the air traffic control philosophy (tactical or strategic) chosen. A rationale is provided to assist in the selection of flow rates and readouts. The relationship of visibility information to the magnitude of terminal information handled by the pilot is discussed. Several display formats are proposed, including one

for the traffic controller and three different options for the pilot.
Author (GRA)

N73-10648# Transportation Systems Center, Cambridge, Mass.
KEYBOARD AND MESSAGE EVALUATION FOR COCKPIT INPUT DATA LINK
E. H. Hilborn Oct. 1971 48 p refs
(AD-744721; DOT-TSC-FAA-71-21) Avail: NTIS CSCL 17/7

The project studied some methods for implementation of the man-machine interface of Digital Data Link for Air Traffic Control. An analysis of information transfer requirements indicated that a vocabulary of less than 200 words could yield meaningful messages for all routine ATC transactions. Keyboard configurations suitable for one-handed operation to yield alphanumeric outputs were studied and a ten-key character selection layout based upon sequential keying of the first two letters of the phonetic alphabet was developed. Author (GRA)

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N73-10649# European Atomic Energy Community, Luxembourg. Fusion Reactor Technology Advisory Group.
SURVEY OF FUSION REACTOR TECHNOLOGY; DEFINITION OF PROBLEMS
1972 304 p refs
(EUR-4873-e) Avail: NTIS HC $17.25

The results of the work of the Fusion Liaison Group are the survey articles included in this report. The reports represent the state of fusion reactor technology at the end of the year 1971 with emphasis only on toroidal reactors with magnetically confined plasma. The topics covered are: systems studies, blanket problems, radiation damage in components of a fusion reactor, plasma-vacuum wall interface and fuel problems, electrotechnical aspects and components. Author

N73-10650*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STUDY OF EXTRATERRESTRIAL DISPOSAL OF RADIOACTIVE WASTES. PART 2: PRELIMINARY FEASIBILITY SCREENING STUDY OF EXTRATERRESTRIAL DISPOSAL OF RADIOACTIVE WASTES IN CONCENTRATIONS, MATRIX MATERIALS, AND CONTAINERS DESIGNED FOR STORAGE ON EARTH
R. E. Hyland, M. L. Wohl, R. L. Thompson, and P. M. Finnegan Oct. 1972 43 p refs
(NASA-TM-X-68147; E-7174) Avail: NTIS HC $4.25 CSCL 18G

The results are reported of a preliminary feasibility screening study for providing long-term solutions to the problems of handling and managing radioactive wastes by extraterrestrial transportation of the wastes. Matrix materials and containers are discussed along with payloads, costs, and destinations for candidate space vehicles. The conclusions reached are: (1) Matrix material such as spray melt can be used without exceeding temperature limits of the matrix. (2) The cost in mills per kw hr electric, of space disposal of fission products is 4, 5, and 28 mills per kw hr for earth escape, solar orbit, and solar escape, respectively. (3) A major factor affecting cost is the earth storage time. Based on a normal operating condition design for solar escape, a storage time of more than sixty years is required to make the space disposal charge less than 10% of the bus-bar electric cost. (4) Based on a 10 year earth storage without further processing, the number of shuttle launches required would exceed one per day. F.O.S.

N73-10651# Atomic Energy of Canada Ltd., Chalk River (Ontario).
AECL RESEARCH IN ENGINEERING
1972 18 p refs
(AECL-4129) Avail: AEC Depository Libraries; Atomic Energy of Can., Ltd., Chalk River: $0.50

Canadian engineering research in nuclear systems and measuring equipment is reported. Data cover nuclear power plant simulation, heavy water production, chemical aspects of boiling reactor coolant, displacement measurement by holographic interferometry, and control scanners for use with digital computers. E.H.W.

N73-10652# Army Foreign Science and Technology Center, Charlottesville, Va.
A TRANSPORTABLE NUCLEAR REACTOR
B. Gerasimov 15 Jun. 1972 4 p Transl. into ENGLISH from Sitsuakuchesyata Industriya (USSR), v. 532, no. 72, 27 Mar. 1971
(AD-745362; FSTC-HT-23-806-72) Avail: NTIS CSCL 18/12

The paper discusses the feasibility of a transportable nuclear reactor to be used in very cold regions. GRA

N73-10653# Nevada Univ., Las Vegas. Desert Research Inst.
THERMONUCLEAR MICRO-BOMB ROCKET PROPULSION Final Report
F. Winterberg Feb. 1972 98 p refs
(Grant AF-AFOSR-1980-71; AF Proj. 9752)
(AD-746027; AFOSR-72-1179TR) Avail: NTIS CSCL 21/6

The report describes an advanced nuclear rocket propulsion system based on a chain of exploding thermonuclear micro-bombs ignited in front of a concave magnetic reflector open at one side. It is shown that for such a propulsion system to work with ideally high efficiency the following conditions have to be satisfied: the thermonuclear material for the micro-bombs has to be a stoichiometric mixture of He3 and D in solid or liquid form, and the ignition of the micro-bombs has to be accomplished by an intense relativistic electron beam. Author (GRA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology; and 29 Space Radiation.

N73-10654# Technisch Physisch Dienst TNO-TH, Delft (Netherlands).
INVESTIGATION OF MODULATED TRANSFER FUNCTION (MTF) MEASURING METHODS [ONDERZOEK MTF-MEETMETHODE.]
C. Smorenburg 26 Mar. 1972 31 p refs In DUTCH
(TPD-1972-0-1; TDCK-59675) Avail: NTIS HC $3.75

Image contrast transfer measurements on optical lenses and lens systems by ODETA apparatus are reported. The device uses an optical arrangement with Foucault intersection of the image to produce on the detector intensity sine waves from which the line spreading functions are found. Fourier transformation of the line spreading function gives the desired contrast transfer function. Transl. by G.G.

N73-10655# Technisch Physisch Dienst TNO-TH, Delft (Netherlands).
CONTRAST TRANSFER ENHANCEMENT OF AN OBJECTIVE THROUGH REDUCTION OF SEPARATING ABILITY [CONTRASTOVERDRACHTVERHOGING VAN EEN ORJECTIEF DOOR VERLAGING VAN HET SCHEIDEND VERMOGEN]
F. TenBrug, A. VanMilaan, and W. Werner 22 Mar. 1972 21 p In DUTCH
(TPD-1972-0-2; TDCK-59796) Avail: NTIS HC $3.25

Contrast transfer enhancement of a lense system through reduction of its line separating capacity is analyzed by producing line patterns in sinus form for minimal and maximal intensities. Contrast enhancement calculations as functions of sine wave line frequencies for area weighted average resolution increase contrast transfer three fold in an aerial camera lens system. Transl. by G.G.

N73-10656*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ENERGY DISTRIBUTION FUNCTIONS OF KILOVOLT IONS

IN A MODIFIED PENNING DISCHARGE
J. Reece Roth 1972 25 p refs Presented at 14th Ann. meeting of the Plasma Phys. Div. of the Am. Phys. Soc., Monterey, Calif., 13-16 Nov. 1972
(NASA-TM-X-68150; E-7181) Avail: NTIS HC $3.25 CSCL 20C

The distribution function of ion energy parallel to the magnetic field of a Penning discharge was measured with a retarding potential energy analyzer. Simultaneous measurements of the ion energy distribution function perpendicular to the magnetic field were made with a charge-exchange neutral detector. The ion energy distribution functions are approximately Maxwellian, and their kinetic temperatures are equal within experimental error. This suggests that turbulent processes previously observed Maxwellianize the velocity distribution along a radius in velocity space, and result in an isotropic energy distribution. The kinetic temperatures are on the order of kilovolts, and the tails of the ion energy distribution functions are Maxwellian up to a factor of 7 e-folds in energy. When the distributions depart from Maxwellian, they are enhanced above the Maxwellian tail. Above densities of about 10 to the 10th power particles/cc, this enhancement appears to be the result of a second, higher temperature Maxwellian distribution. At these high particle energies, only the ions perpendicular to the magnetic field lines were investigated. Author

N73-10657# RAND Corp., Santa Monica, Calif.
COMPUTER TECHNIQUES FOR PSEUDOCOLOR IMAGE ENHANCEMENT
J. V. Lamar, R. H. Stratton, and J. J. Simac Jul. 1972 10 p refs Presented at USA - Japan Computer Conf., Tokyo, 3-5 Oct. 1972
(P-4870) Avail: NTIS HC $3.00

Techniques are discussed for the reconstruction of processed digital data into image form by photographic image obtained from a microfilm plotter. Enhancement techniques considered include: photographic and computer generated separators, pseudocolor system in which color is keyed to density gradient, pseudocolor system in which hue is keyed to density level and brightness is keyed to density gradient, and mapping. F.O.S.

N73-10658# RAND Corp., Santa Monica, Calif.
VIDEO GRAPHICS PERFORMANCE EVALUATION, BEFORE AND AFTER IMPLEMENTATION
T. E. Bell Jul. 1972 22 p Presented at Symp. on Time-Sharing and Multi-Access Computing in the 70s, Santa Monica, Calif., 9-11 Nov. 1971; sponsored by ONR and System Develop. Corp.
(P-4830) Avail: NTIS HC $3.25

The performance of on-line systems is discussed in terms of the interactions of their hardware and software. Before implementation performance evaluation is compared with performance evaluation after implementation for a video graphics system. It is concluded that: (1) Detailed simulation analysis can be a very useful tool in designing and implementing on-line systems. (2) Simulation of alternatives can lead to improved gross characterizations of the system through intensive analysis of differences. (3) Absolute errors may be incurred in simulations in spite of significant efforts to eliminate them. F.O.S.

N73-10659# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.
IRRADIATION EFFECTS IN SUPERCONDUCTING SYNCHROTRON MAGNETS
H. Brechna and W. Maurer Sep. 1971 30 p refs
(KFK-1468) Avail: AEC Depository Libraries

Synchrotron magnets placed at some distances downstream or upstream from septum magnets and targets are exposed to nuclear radiation. An estimate of the dose rate, pattern, and distribution of scattered particles and neutron is presented. The effect of irradiation on superconducting composites, matrix materials, insulation, magnet stability, and increase in ohmic losses is given. The generation of defects and the effect on defect-clusters are calculated as functions of energy levels. Performance problems of superconducting magnets exposed to an irradiation environment are described. Author (NSA)

N73-10660# Rome Univ. (Italy). Inst. of Physics.
EQUILIBRIUM STATES OF AN ISING FERROMAGNET IN THE LOW TEMPERATURE REGION
D. Capocaccia, M. Cassandro, and G. Cicotti 8 Jun. 1972 21 p refs
(Nota-Interna-381) Avail: NTIS HC $3.25

The low temperature properties of an Ising ferromagnet were investigated assuming that the nearest neighbor coupling constant is dominant. It is shown that all the translationally invariant equilibrium states are a superposition of only two extreme (or extremal) states. Author (ESRO)

N73-10661# Rome Univ. (Italy). Inst. of Physics.
THE MULTIPLICATIVE RENORMALIZATION GROUP AND THE CRITICAL BEHAVIOUR IN d EQUALS 4 MINUS SIGMA DIMENSIONS
C. DiCastro 20 Jun. 1972 11 p refs
(Nota-Interna-384) Avail: NTIS HC $3.00

The multiplicative renormalization group is used to calculate the critical indices for Ising-like, X-Y, and Heisenberg-like models. The renormalization group equations for a theory (sq psi) in d dimensions is derived considering a system of bosons interacting via a two-body point potential above the critical temperature. Author (ESRO)

N73-10662# Michigan Univ., Ann Arbor. Cooley Electronics Lab.
THE MIMI FIELD TEST OF JULY 1970
Richard M. Heitmeyer Jun. 1972 43 p
(Contract N00014-67-A-0181-0032)
(AD-744982; TR-217; Rept-036040-10-T) Avail: NTIS CSCL 20/1

In the summer of 1970, a field test was conducted to determine if a portable signal processing unit built around a small digital computer could be used to run specific underwater propagation experiments in the Straits of Florida. A periodic broadband signal modulating a 420 Hz carrier was transmitted continuously across the Straits of Florida for 9 days. At the receiving site, the power and phase angle of the carrier, the power in the signal sidebands and the noise power in the signal band were measured. In addition, the total power and the power spectrum in a narrow band about the carrier line were determined as a measure of the modulation due to the forward-scattered surface reverberation. Author (GRA)

N73-10663# School of Aerospace Medicine, Brooks AFB, Tex.
PURE-TONE THRESHOLD WITH TDH-49 EARPHONES
Progress Report, Jun. 1971 - May 1972
Harrell C. Sutherland, Jr. and Donald C. Gasaway Jun. 1972 16 p refs
(AF Proj. 7755)
(AD-744823; SAM-TR-72-17) Avail: NTIS CSCL 09/1

Pure-tone thresholds of 24 normal-hearing listeners were determined at 11 audiometric frequencies on two TDH-49 and two TDH-39 earphones. Thresholds were recorded in decibels of sound pressure level, as measured with a National Bureau of Standards type 9-A earphone coupler. Threshold data were used to compute appropriate calibration values for audiometers with TDH-49 earphones, reference Appendix F of ANSI S3.6-1969. Author (GRA)

N73-10664# Aerophysics Research Corp., Bellevue, Wash.
ARCTIC SURVEY SITE Technical Report, 1 Apr. - 30 Jun. 1972
T. S. Chow 12 Jul. 1972 7 p
(Contract N00014-72-C-0335; ARPA Order 1779)
(AD-745313) Avail: NTIS CSCL 20/1

The report discusses the development of a ray tracing program for calculating the sound intensity from sources in the ocean with surface and bottom reflections. Salinity and temperature gradients have been taken into consideration to calculate the sound velocity and absorption loss. The sound intensity is calculated by energy considerations included in the ray tube of adjacent rays. A formula has also been developed for calculating the intensity along a ray without considering the variation in the ray tube area. This involves the calculation of the radius of curvature of the wave front along the ray. Future plans on ray tracing call for the development of techniques for calculating sound intensities in the caustic region and higher order corrections. Author (GRA)

N73-10665# Army Foreign Science and Technology Center, Charlottesville, Va.
THREE-COMPONENT OPTICAL SYSTEM WITH A VARIABLE FOCAL LENGTH FOR THE INFRARED REGION OF THE SPECTRUM
V. G. Pospekhov 14 Jun. 1972 5 p ref Transl. into ENGLISH from Priborostroenie (Moscow), v. 10, no. 11, 1967 p 86-88
(AD-745356; FSTC-HT-23-462-70) Avail: NTIS CSCL 20/6

The paper describes the pancratic lens designed at the Moscow Higher Technical School im. N. E. Bauman and based on the principles of focal length variation elaborated by Professor V. N. Churilovskiy. A characteristic feature of the lens consists in the fact that there is no need to make curving grooves in order to displace the components. Curvilinear displacement of the components is accomplished by means of a simple lever and hinge mechanism. Author (GRA)

N73-10666# National Bureau of Standards, Washington, D.C.
THE ECONOMIC IMPACT OF NOISE
31 Dec. 1971 112 p refs
(PB-206726; EPA-NTID300.14) Avail: NTIS HC $3.00 CSCL 13B

A study was undertaken to survey the economic impact of noise. Data available are so rudimentary that they do not lend themselves to even the most primitive economic analysis. It is demonstrated that the number of sources of noise in homes, in industry, on the highways, and in the air is growing at a dramatic rate. It is also shown that substantial costs are associated with noise and its abatement. Costs such as those associated with equipment redesign, right-of-way, and receiver insulation are discussed in detail. A discussion of spending for noise research is included in the study. Author (GRA)

N73-10667# Naval Undersea Research and Development Center, San Diego, Calif.
LONG-RANGE ACOUSTIC PROPAGATION IN THE SHALLOW BERING SEA Research Report, 1960 - 1972
Kenneth V. Mackenzie Jun. 1972 92 p refs
(AD-745735; NUC-TP-293) Avail: NTIS CSCL 20/1

Propagation measurements were obtained with explosives and CW signals of 58, 350, 700, and 1300 Hz in 25-fathom waters of the Bering Sea. Sound was received by an anchored string of 14 hydrophones spaced vertically at 10-ft intervals. Measurements to ranges of 80 kyd were confined to areas that had previously been surveyed acoustically to determine sediment properties and thicknesses. CW tones exhibited amplitude fluctuations of 50 dB with attendant frequency spreading. Empirical equations are presented describing resultant half-power spectra as a function of range and frequency. Pressure levels, each based on 6000 to 10,000 data points, demonstrated a hydrophone depth dependence with minimal evidence of mode-stripping. Propagation anomalies for 700 and 1300 Hz agree with energy flux density procedures, provided a sufficiently low attenuation in the bottom is assumed. Author (GRA)

N73-10668# Naval Coastal Systems Lab., Panama City, Fla.
DESIGN, CONSTRUCTION, AND EVALUATION OF LIQUID AND SOLID ULTRASONIC LENSES Formal Report
D. L. Folds Jun. 1972 84 p refs
(AD-745734; NCSL-117-72) Avail: NTIS CSCL 20/1

The sound velocity, thermal coefficient of sound velocity, and attenuation coefficients of 20 common plastics were measured and used as a basis for the design of several lenses. Materials selected were polyethylene, nylon, polystyrene, polyphenylene oxide, and a low sound velocity silicone rubber compound. Using common geometrical optical techniques, lenses were designed to minimize off-axis aberrations for focal-length-to-aperture ratios ranging from one to three and aperture to wavelength ratios up to 150. Using methods analogous to chromatic aberration correction in optics, lenses were designed for constant focal length over a temperature range of 0 to 30 C. Two- and four-element lens systems with apertures up to 30 cm were fabricated. Measurements were made in the frequency range 600 kHz to 1.2 MHz. The theoretical model used to evaluate lens performance was based on the numerical evaluation of the Fresnel-Kirchoff diffraction integral. Author (GRA)

N73-10669# Naval Postgraduate School, Monterey, Calif.
THE SPEED OF SOUND AND OTHER THERMODYNAMIC QUANTITIES OF DILUTE AQUEOUS ELECTROLYTE SOLUTIONS BY AN ULTRASONIC VELOCIMETER COMPARISON TECHNIQUE M.S. Thesis
William Montgomery Raymond Jun. 1972 54 p refs
(AD-745843) Avail: NTIS CSCL 20/1

A very precise velocimeter has been developed and used to measure changes in the speed of sound as a function of the concentration of aqueous electrolyte solutions. The experimental results indicated that the speed of sound can be measured with a precision of plus or minus 3 cm/sec. The ratios of superposition frequencies vs. pressure, over the pressure range of 0 to 1500 psi in increments of 500 psi, and temperature, over the temperature range of 35 to 55 C in increments of 10 C, were obtained. Author (GRA)

N73-10670# Naval Ordnance Lab., White Oak, Md.
PROPAGATION OF A WEAK SHOCK WAVE THROUGH A TURBULENT MEDIUM
Ralph E. Phinney and Leonard S. Taylor 31 May 1972 26 p refs
(AD-745728; NOLTR-72-130) Avail: NTIS CSCL 20/1

The propagation of a weak nearly plane shock wave through a slightly inhomogeneous medium was studied. The equations for a finite strength shock wave are used as a starting point in order that the cumulative effect of second order terms will not be lost. The motivation for the study was the experimental observation that atmospheric turbulence can alternately focus and defocus weak waves from an aircraft. A more detailed understanding of the influence of atmospheric turbulence on this problem was sought. The basic equations are derived, and some preliminary results are obtained. Author (GRA)

N73-10671# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
HUD NOISE ASSESSMENT GUIDELINES TECHNICAL BACKGROUND (TECHNICAL BACKGROUND FOR NOISE ABATEMENT IN HUD'S OPERATING PROGRAMS) Final Report
Theodore J. Schultz Dec. 1971 264 p refs
(PB-210591; BBN-2005R) Avail: NTIS HC $4.00; SOD HC $2.00 as 2300-0190 CSCL 13M

Discussions on the need for noise abatement, the various techniques for measuring and describing noise and human responses to it along with inter-rating comparisons are presented. Criteria of acceptability are discussed along with summaries of existing legislation and recommendations in foreign countries and the United States. The technical background information for the development of site noise assessment techniques is given. Author (GRA)

N73-10672# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
HUD NOISE ASSESSMENT GUIDELINES Final Report
Theodore J. Schultz and Nancy M. McMahon Aug. 1971 36 p (Contract HUD-H-1498)
(PB-210590; BBN-2176; HUD-TE/NA-171) Avail: NTIS HC $2.70; SOD HC $0.70 as 2300-1194 CSCL 13B

An outline is made of the procedures that can be used by persons who do not have technical training in acoustics for making assessments of present and predicted noise exposure at sites proposed for new residential construction. Determinations are based upon noise produced by various transportation modes. Sophisticated acoustical measurement equipment is not required of the user. Author (GRA)

N73-10673# California Inst. of Tech., Pasadena. Antenna Lab.
SCALAR DEBYE POTENTIALS FOR ELECTROMAGNETIC FIELDS IN SPHERICAL GRAVITY AND SPHERICAL MEDIA, 1
Tse Chin Mo and Charles H. Papas May 1972 22 p refs
(Grant AF-AFOSR-1935-70; AF Proj. 9768)
(AD-746047; TR-64; AFOSR-72-1231TR) Avail: NTIS CSCL 20/10

Modified scalar Debye potentials for electromagnetic (EM) waves in spherical gravity and spherical media are found. These potentials decompose the EM waves into two completely independent electric and magnetic radial modes and achieve scalarization and boundary fitting. Their equations are reduced

to one dimensional Helmholtz equations under a separability condition, and can have their gravity effect nullified by a particular medium. Also the reflection coefficent (R sub l) for a l-spherical wave satisfies a Ricatti equation, and the phase shifts (delta sub l) and scattering cross sections are related to (R sub l). For an incident plane EM wave, the non-forward differential scattering cross section is expressed in terms of the (R sub l) for the case where the medium and/or gravity tapers off slower than 1/(radius) and (R sub l), (delta sub l) themselves diverge. Author (GRA)

N73-10674# Delaware Univ., Newark. Dept. of Mathematics.
LOW FREQUENCY SCATTERING BY IMPERFECTLY CONDUCTING OBSTACLES
John S. Asvestas Apr. 1972 91 p refs
(Grant AF-AFOSR-1794-69; AF Proj. 9749)
(AD-746048; Rept-1794-4; AFOSR-72-0807TR) Avail: NTIS CSCL 20/14

Four coupled Fredholm integral equations of the second kind are derived for the electric and magnetic fields interior and exterior to a smooth, bounded, closed, three dimensional scatterer of permittivity, permeability, and non-zero finite conductivity, when the scatterer is illuminated by a time harmonic, monochromatic, otherwise arbitrary field. The surrounding medium has the properties of vacuum. The kernels of these equations are dyadics constructed from potential functions associated with the scattering surface. If the frequency of the incident field is sufficiently small, the integral equations may be solved in a standard Neumann series. Author (GRA)

N73-10675# Committee on Sonar Model Standards (Navy), Washington, D.C.
NAVSHIPS DIGITAL DATA CODING INSTRUCTIONS FOR THE UNDERWATER ACOUSTIC AND ENVIRONMENTAL DATA BANK (NAVDAB)
Jun. 1972 38 p
(Contract N00024-72-C-1232)
(AD-746507; COSMOS-3) Avail: NTIS CSCL 20/1

The Naval Ship Systems Command has created a data bank for certified underwater acoustic and environmental data. The data bank is to be used in the construction and validation of underwater acoustic models. The report contains a description of the data bank and its operation, together with instructions for the coding of information to be entered in the bank.
Author (GRA)

N73-10676# Naval Research Lab., Washington, D.C.
AN ALGORITHM FOR CALCULATING THE ECHO SIGNALS FROM AN ELASTIC SPHERICAL SHELL IN LIQUID BY THE SUMMATION OF INDIVIDUAL GROUPS OF PROGRESSIVE WAVES
Ya. A. Metsaveer 5 Jul. 1972 32 p refs Transl. into ENGLISH of "Vychisleniya Ekho-Signalov ot Uprugoi Sferich. Obolochki v Zhidkosti Putem Summirovaniya Otd. Grupp Begushchikh Voln" Preprint no. 3 Akad. Nauk Est. SSR, Inst. Kibervetiki, Tallinn, 1971
(AD-746220; NRL-Trans-1252) Avail: NTIS CSCL 20/1

The paper considers a mathematical description of the echo pulses from an elastic spherical shell in a liquid which arise as a result of the action of an incident pulse. The motion of the shell is described by a theory of the Timoshenko type, and the fluid is assumed to be ideal and compressible. Author (GRA)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N73-10677 National Bureau of Standards, Washington, D.C. Office of Standard Reference Data.
SELECTED TABLES OF ATOMIC SPECTRA. A: ATOMIC ENERGY LEVELS, SECOND EDITION. B: MULTIPLET TABLES H 1, D, T
Charlotte E. Moore and E. O. Hulburt (NRL) Sep. 1972 37 p (NSRDS-NBS-3-Sect-6) Copyright. Avail: SOD $0.40 as C 13.48:3/Sec. 6

A current revision of two sets of tables containing data on atomic spectra as derived from analyses of optical spectra is presented. Part A contains the atomic energy levels and Part B the multiplet tables. The spectra of hydrogen and of the isotopes deuterium and tritium are included. The form of presentation is described in detail. Author

N73-10678# European Atomic Energy Community, Geel (Belgium).
CALCULATIONS FOR FISSION NEUTRON AND GAMMA MULTIPLICITY MEASUREMENTS
J. P. Theobald, J. A. Wartena, and W. Kolar 1972 24 p refs
(EUR-4829-E) Avail: NTIS HC $3.25

A set of detectors can be used to measure multiplicities of neutron or gamma quanta emitted in fission. Subsets of these detectors can be linked with coincidence units. Probabilities for x-fold coincidences are calculated for a given number of emitted particles or quanta. Methods of combinational analysis were applied. Author

N73-10679# Commission of the European Communities, Brussels (Belgium).
RADIOECOLOGY APPLIED TO THE PROTECTION OF MAN AND HIS ENVIRONMENT, 1
May 1972 806 p refs Partly in ENGLISH; partly in FRENCH, partly in GERMAN; partly in ITALIAN; partly in DUTCH Conf. held at Rome, 7-10 Sep. 1971
(EUR-4800-d-f-i-e-Pt-1) Avail: NTIS HC $42.50

Developed is a health policy in regard to ionizing radiation that considers the protection of populations in setting up acceptable levels of radioactive waste permitting the limitation and control of pollution in areas surrounding nuclear installations. Radioecology encompasses the complex biological phenomena which characterize the passage of radioactive materials in the environment. G.G.

N73-10680# Commission of the European Communities, Brussels (Belgium).
RADIOECOLOGY APPLIED TO THE PROTECTION OF MAN AND HIS ENVIRONMENT, 2
May 1972 632 p refs Partly in ENGLISH, partly in FRENCH; partly in GERMAN; partly in ITALIAN; partly in DUTCH Conf. held at Rome, 7-10 Sep. 1971
(EUR-4800-d-f-i-e-Pt-2) Avail: NTIS HC $33.75

Mathematical models are formulated and used to define radiation transfer parameters and the resultant pollution of man's environment in order to obtain protective safety standards. The importance of radiation ecology in monitoring nuclear installations is considered. G.G.

N73-10681# European Atomic Energy Community, Ispra (Italy).
JN-METD2: A FORTRAN IR PROGRAMME FOR SOLVING NEUTRON TRANSPORT PROBLEMS WITH ISOTROPIC SCATTERING IN MULTILAYER SLABS BY THE j SUB N METHOD
T. Asaoka and E. Caglioti Bonanni Jul. 1972 58 p refs
(EUR-4839-e) Avail: NTIS HC $5.00

The mathematical formulas of the j sub N method for the description of neutron transport in a multilayer slab system are summarized within the context of a multigroup model under the assumption that the scattering of neutrons is spherically symmetric in the laboratory system. A FORTRAN-4 computer program is described in detail for solving the transport problem according to these formulas. The computer code calculates the eigenvalue of the integral transport equation, the effective multiplication factor or the asymptotic decay constant of neutrons, as well as the eigenfunction, and the space, angle and energy dependent flux distribution. In addition, it evaluates the first three time moments of the time-dependent flux resulting from a delta function boundary source with space, angle, and energy variables.
Author

N73-10682# Defence Research Establishment Valcartier (Quebec).
COLLISIONAL DEACTIVIATION OF O2(1 DELTA g)
F. D. Findlay and D. R. Snelling Jul. 1972 26 p refs

(DREV Proj. 95-10-42)
(DREV-TN-2010/72) Avail: NTIS HC $3.50

Determinations are reported for collisional deactivation rate constants for O2 by minor atmospheric constituents and other gases. The benzene-oxygen photochemical system was used to produce O2 and relative concentrations were measured by monitoring the intensity of its emission at 1.27 microns. The rate constants for the reaction O2(1 Delta g) + M yields O2 + M are given. Upper limits were obtained for deactivation by He, Ar, CO2 and SF6. Author

N73-10683# Maryland Univ., College Park. Center for Theoretical Physics.
ASYMPTOTIC BEHAVIOR OF ELASTIC FORM FACTORS AND THE LIGHT CONE
Patrizio Vinciarelli and Peter Weisz Oct. 1972 7 p refs Submitted for publication
(Grant NSF GU-2061)
(TR-73-039) Avail: NTIS HC $3.00

An interesting connection relating the asymptotic behavior of elastic form factors to integral conditions on the light cone expansion for one-particle forward matrix elements of products of two currents is established. Author

N73-10684# Virginia Univ., Charlottesville. Dept. of Physics.
SCALING BEHAVIOR OF THE CUTOFF VECTOR GLUON MODEL
Paul M. Fishbane (Ill. Univ., Urbana) and J. D. Sullivan [1972] 35 p refs
(Grant NSF GP-25303)
(ILL-(TH)-72-10) Avail: NTIS HC $3.75

In a leading logarithm approximation, the deep inelastic scattering and annihilation structure functions in the Bjorken limit are computed after appending a transverse momentum cutoff to the neutral vector gluon model. Detailed results such as the analyticity relation and the reciprocal relation between scattering and annihilation are sensitive to the method of cutoff. Although the structure functions obey Bjorken scaling, scaling is broken channel by channel, unlike the cutoff y sub 5 field theory. This feature is reflected by the multiplicity which grows approximately lnq squared in the cutoff vector gluon model. Author

N73-10685*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE RELATION BETWEEN MOMENTUM TRANSFER AND CAPTURE AND TOTAL SCATTERING CROSS SECTIONS FOR ION-DIPOLE COLLISIONS
John V. Dugan, Jr. 1972 10 p refs Presented at 25th Gaseous Electron. Conf., London, Ontario, 17-20 Oct. 1972
(NASA-TM-X-68151; E-7182) Avail: NTIS HC $3.00 CSCL 20H

Numerical values of momentum transfer cross sections sigma sub m for ion-dipole collisions are compared with the corresponding capture cross sections sigma sub c as a function of ion velocity and rotational temperature. For values of dipole moment mu from 1 to 4 Debyes the sigma sub m/sigma sub c ratio is in the range 1.2 to 2.0 (roughly). This is in contrast to the simple relation for Langevin collisions where sigma sub m/sigma sub c is equal to or approximately 1.10 independent of polarizability of the target atom. At low temperatures, the momentum transfer cross sections can be as large as 2000 A squared but they are only about 15 to 30 percent of the total scattering cross sections sigma sub S. Author

N73-10686# Northeastern Univ., Boston, Mass.
SEARCH FOR NARROW RESONANCES IN THE R REGION
D. Bowen, D. Earles, W. Faissler, D. Garelick, M. Gettner, M. Glaubman, B. Gottschalk, G. Lutz, J. Moromisato, E. I. Shibata et al Sep. 1972 12 p refs Prepared in cooperation with State Univ of New York, Stony Brook
(Grants NSF GP-9217; NSF GP-25307; NSF GP-32952)
(NUB-2160) Avail: NTIS

Measurement is considered of the missing mass, (mm)(-), spectrum from the reaction pion(-) + p yields (mm)(-) + p at 8 GeV. The data contain 6500 events in the R peak. The R shape is consistent with either a single Breit-Wigner or several wide resonances, as suggested by bubble chamber experiments, but inconsistent with the series of narrow resonances reported by the CERN missing mass group. Author

N73-10687# Northeastern Univ., Boston, Mass. Dept. of Physics.
NUCLEAR MAGNETIC RELAXATION OF He-3 IMPURITY GAS IN SOLID He-4
Allan Wicom and M. G. Richards Sep. 1972 10 p refs Prepared in cooperation with Sussex Univ., Brighton, Engl.
(NUB-2155) Avail: NTIS HC $3.00

A theory is presented of nuclear magnetic relaxation in the He-3 impuriton gas. Experimental methods of obtaining the single particle energy spectrum and the two-impuriton collision cross section are considered. Author

N73-10688*# National Aeronautics and Space Administration, Washington, D.C.
QUANTUM THEORY OF THE GLOWING ELECTRON, 3
A. A. Sokolov and I. M. Ternov Sep. 1972 29 p refs Transl. into ENGLISH from Zh. Eksperim. Teor. Fiz. (Moscow), v. 25, no. 6 (12), 1953 28 p
(NASA-TT-F-14495) Avail: NTIS HC $3.50 CSCL 20H

Quantum corrections to the trajectories of radiating fast electrons in a magnetic field are determined using cylindrical coordinates. Spontaneous transitions, the change in trajectory during transition, and radiation intensity are also discussed. For Part 1, see N72-32676; for Part 2, see N72-32677. Author

N73-10689# Rome Univ. (Italy). Inst. of Physics.
A FIELD THEORETICAL MODEL FOR THE CRITICAL BEHAVIOUR OF He4 ABOVE LAMBDA POINT
F. DePasquale and P. Tombesi 10 May 1972 24 p refs
(Nota-Interna-374) Avail: NTIS HC $3.25

It is shown that the critical behavior of He-4 above critical point can be described in terms of a peculiar solution of a set of approximate equations. The equations are related to a field theoretical model describing a system of bosons interacting via a phonon like field. The basic set of equations is derived by means of rather general physical arguments from an exact set of identities of the theory. The solution which describes the critical behavior is only asymptotically valid if an effective coupling constant is associated with the model, reaches a nontrivial fixed point as the correlation length goes to infinity. In the asymptotic region the scaling law is derived. The nontrivial fixed point, the rate of approach to the asymptomic region, and the critical index are calculated with an approximate method. The results are functions of the dimensionality parameter. For dimensionality d > 4 the expected classical critical behavior is recovered.
ESRO

N73-10690# Rome Univ. (Italy). Inst. of Physics.
POTENTIAL BARRIER FOR NEUTRAL EXCITATIONS AT THE LIQUID HELIUM SURFACE
P. Calvani and B. Maraviglia 12 May 1972 16 p refs Sponsored in part by CNR
(Nota-Interna-375) Avail: NTIS HC $3.00

The behavior of neutral excitation (NE) at the liquid helium surface was investigated. The existence of a potential barrier at the liquid-vapor interface, which can partially prevent the evaporation of NE from the liquid is demonstrated theoretically. Neutral excitation is calculated in liquid helium, at the liquid surface, and in the barrier. Experiments have shown that NE can cross the barrier at the liquid-vapor interface by means of thermal excitation. It was also shown that pairs of positive and negative ions are produced by NE-NE annihilation in the vapor.
Author (ESRO)

N73-10691# Rome Univ. (Italy). Inst. of Physics.
ORDER PARAMETER FOR ROTATIONAL ORDERING TRANSITIONS IN DIATOMIC MOLECULES BY NMR
C. Beccari 12 May 1972 15 p refs Sponsored in part by CNR
(Nota-Interna-376) Avail: NTIS HC $3.00

The presence of a doublet (Pake doublet) in the nuclear magnetic resonance spectrum of diatomic molecules is related to the rotational order parameter of these systems. The measurement of the doublet separation gives the order parameter directly. Particular cases are treated by observing the Pake doublet for a nonrotating pair, for a classically rotating pair, and

for solid deuterium and hydrogen, by determining and defining a temperature dependent order parameter. Author (ESRO)

N73-10692# Rome Univ. (Italy). Inst. of Physics.
THE PROBLEM OF CONTINUATION FROM DEEP INELASTIC ELECTRON SCATTERING TO DEEP ELECTRON-POSITRON ANNIHILATION
R. Gatto and G. Preparata 22 May 1972 33 p refs
(Nota-Interna-378) Avail: NTIS HC $3.75

Direct applications are reported of light cone expansion to the analysis of matrix elements between physical and vacuum states of operator products of currents which are electron-positron annihilation cross sections into hadrons, proton and electron inelastic scattering in the Bjorken limit, and processes such as muon pair production. The problem of analytical continuation from deep inelastic electron scattering to deep electron-positron annihilation is studied by analyzing the forward asymptotic Compton amplitude, studying its analyticity properties and discontinuities, and introducing the light cone representation. The assumption that the total annihilation hadronic cross section behaves like the point-like cross section leads to nontrivial Bjorken scaling for the deep inelastic annihilation which is not obtainable in general from the deep inelastic scattering. Author (ESRO)

N73-10693# Rome Univ. (Italy). Inst. of Physics.
TRIPLE-REGGE PHENOMENOLOGY FROM FINITE MASS SUM RULES IN SINGLE PARTICLE INCLUSIVE REACTIONS
A. Bietti 22 May 1972 9 p refs
(Nota-Interna-379) Avail: NTIS HC $3.00

Finite mass sum rules are applied to the reaction proton + proton yields positive pion, negative pion, negative kaon, or positive kaon + anything, in order to obtain the high missing mass behavior in terms of an integral over the low and intermediate mass amplitudes. The results are in reasonable agreement with CERN data obtained at incident laboratory momenta of 24 and 19.2 GeV/C, particularly for the positive and negative kaon reactions, and with the predictions of the triple-Regge model. Author (ESRO)

N73-10694# Rome Univ. (Italy). Inst. of Physics.
ONE-BOSON-EXCHANGE POTENTIALS AND UNCLEAR STRUCTURE
F. Calogero and D. Levi 22 May 1972 15 p refs Submitted for publication
(Nota-Interna-380) Avail: NTIS HC $3.00

Results of tests on one-boson-exchange potential carried out over the last few years are reported and discussed. These results were obtained in the framework of nonrelativistic quantum mechanics assuming that the nucleons interact via a two-body potential and that their dynamics are determined by the many-body Schroedinger equation. It is pointed out that several of the recently proposed one-boson-exchange nucleon-nucleon potentials, while fitting accurately the two-nucleon data, give unsatisfactory results in the many-nucleon context. Author (ESRO)

N73-10695# Rome Univ. (Italy). Inst. of Physics.
A STUDY AND A NEW TABULATION OF FORWARD PION-NUCLEON SCATTERING AMPLITUDES
E. Ferrari 9 Jun. 1972 100 p refs Sponsored partly by Fondazione Francesco Somaini
(Nota-Interna-382) Avail: NTIS HC $7.00

The forward real parts and the whole forward pion-nucleon scattering amplitude can be determined from data obtained on forward pion-nucleon total cross sections through forward dispersion relations. A new selection of total cross sections and a further calculation of the complete amplitudes are presented and the errors affecting the experimental data discussed. Special attention is paid to data consistency problems in the very low energy range such as threshold and immediately above. Author (ESRO)

N73-10696# Rome Univ. (Italy). Inst. of Physics.
A COINCIDENCE EXPERIMENT ON PI(+) ELECTROPRODUCTION NEAR THRESHOLD
E. Amaldi, M. Beneventano, B. Borgia, F. DeNotaristefani, A. Frondaroli, P. Pistilli, I. Sestili, and M. Severi 16 Jun. 1972 40 p refs
(Nota-Interna-383-A) Avail: NTIS $4.00

The cross section for electroproduction of positive pions at threshold was measured for two values of the four momentum by measuring the electrons scattered inelastically in coincidence with the neutrons produced in the reaction electron + proton yields electron + neutron + positive pion. The experimental results obtained as well as those of previous experiments (at - Sq K = 0.20 Sq GeV/C) are analyzed by the different methods in order to determine the isovector axial form factor of the nucleon. The results of the two analyses agree within the experimental error of about 10%. The isovector axial form factor is well represented by the dipole expression Ma = (1.02 + or - 0.04)GeV. Author (ESRO)

N73-10697# Rome Univ. (Italy). Inst. of Physics.
UNIDIMENSIONAL MOTION IN AN ELECTRIC INHOMOGENEOUS FIELD WITH COULOMBIAN POTENTIAL (QUANTUM-MECHANICAL TREATMENT)
V. Malvestuto and F. Zirilli (Scuola Norm. Super., Pisa, Italy) 14 Jun. 1972 9 p ref
(Nota-Interna-383-B) Avail: NTIS HC $3.00

Unidimensional motion of a charged particle in an electric isotropic field with Coulomb potential is treated using the Schroedinger equation for the particle's eigenstates. Restrictions are found on the external potential necessary to assure that a discrete spectrum of bounded eigenstates still exists with respect to those of Coulomb field. Author (ESRO)

N73-10698# Mission Research Corp., Santa Barbara, Calif.
COLLISIONAL ASPECTS OF THE AVCO EXPERIMENT Interim Report
Ralph W. Kilb Jul. 1972 35 p refs
(Contract DASA01-71-C-0054)
(AD-745374; MRC-R-18; DNA-28781) Avail: NTIS CSCL 07/4

The gross features of the 45 mtorr Avco experiment with and without an applied magnetic field can be explained by the difference between a momentum snowplow and an energy conserving shock. The initial ionization of the air appears to be very low. With no applied field, the ionization apparently remains low, the shock is dominated by atom-atom and ion-atom collisions, and the UV radiation loss is relatively small, yielding an energy conserving shock. With a 200 gauss applied field, the ionization apparently is rapid in the shock front, leading to large ion-electron collisional heat transfer and associated UV losses, thereby producing a momentum snowplow. The details of how the magnetic field induces rapid ionization are not clear. Author (GRA)

N73-10699# Naval Ordnance Lab., White Oak, Md.
TRIN: COMPUTER PROGRAM TO CALCULATE TEMPERATURE DISTRIBUTIONS IN CIRCULAR AND RECTANGULAR SECTIONS EXPOSED TO THERMAL RADIATION FROM NUCLEAR WEAPON EXPLOSIONS
David M. Dancer and Donald M. Wilson 12 May 1972 65 p refs
(SF26553001)
(AD-745727; NOLTR-72-117) Avail: NTIS CSCL 18/3

A Computer program (TRIN) has been developed to calculate temperature distributions, in two or three dimensions, in bodies of rectangular or circular cross section exposed to transient thermal radiation heating from a nuclear weapon detonation. The cross section may be solid or hollow, the body may rotate or be stationary and the thermophysical properties can be arbitrary functions of local temperature. Capability of calculating distributions in three dimensions has been included to account for effects of heat sinks at the boundaries of the element. Solution of the heat conduction equation is accomplished by TRUMP, a well documented and verified computer program which is appended to TRIN as a subroutine. Author (GRA)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N73-10700*# Illinois Univ., Urbana. Dept. of Computer Science.
MONTE CARLO SIMULATION OF NONLINEAR RADIATION INDUCED PLASMAS Ph.D. Thesis
Benjamin Shaw-Hu Wang May 1972 167 p refs
(Grant NGR-14-005-183; Contract AT(11-1)-2007)
(NASA-CR-128405; UIUCDCS-R-27-519) Avail: NTIS HC $10.50 CSCL 20I

A Monte Carlo simulation model for radiation induced plasmas with nonlinear properties due to recombination was, employing a piecewise linearized predict-correct iterative technique. Several important variance reduction techniques were developed and incorporated into the model, including an antithetic variates technique. This approach is especially efficient for plasma systems with inhomogeneous media, multidimensions, and irregular boundaries. The Monte Carlo code developed has been applied to the determination of the electron energy distribution function and related parameters for a noble gas plasma created by alpha-particle irradiation. The characteristics of the radiation induced plasma involved are given. Author

N73-10701# Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland).
ON THE STABILITY OF A SYSTEM IN WHICH ONE PARAMETER OSCILLATES SINUSOIDALLY WITH SMALL AMPLITUDE
G. G. Lister and F. S. Troyon Jul. 1972 25 p refs Sponsored by Fonds Natl. Suisse de la Rech. Sci.
(LRP-53/72) Avail: NTIS HC $3.25

The study of the dynamic stabilization of certain plasma confinement and fluid systems leads to integral equations. An equation is solved for all values of A, and the general stability properties of the system are discussed. General formulas are given which relate the perturbed spectrum on the system to the unperturbed system. For the case where the static system has well separated eigenfrequencies, a perturbation expansion is derived. Author

N73-10702# Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland).
TRANSVERSE DYNAMIC STABILIZATION OF A SCREW PINCH
G. G. Lister, F. S. Troyon, and E. S. Weibel Jul. 1972 13 p refs
(LRP-52/72) Avail: NTIS HC $3.00

The influence of a small, steady axial current on the stability of a straight plasma column confined by a static axial magnetic field and a small oscillating transverse magnetic field is discussed. Stability conditions are derived and compared with those obtained in the absence of the steady current. The possibility of obtaining a toroidal equilibrium by using a steady current which is above the Kruskal-Shavranov limit and of dynamically stabilizing the resultant instability is also discussed. Author

N73-10703*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HEAVY ION PLASMA CONFINEMENT IN AN RF QUADRUPOLE TRAP
J.-P. Schermann and F. G. Major Jul. 1971 35 p refs
(NASA-TM-X-65719; X-524-71-343) Avail: NTIS HC $3.75 CSCL 20I

The confinement of an electron free plasma in a pure quadrupole RF electric trap was considered. The ultimate goal was to produce a large density of mercury ions, in order to realize a trapped ion frequency standard using the hyperfine resonance of 199 Hg(+) at 40.7 GHz. An attempt was made to obtain an iodine plasma consisting of equal numbers of positive and negative ions of atomic iodine, the positive iodine ions, being susceptible to charge-exchange with mercury atoms, will produce the desired mercury ions. The experiment showed that the photoproduction of ions pairs in iodine using the necessary UV radiation occurs with a small cross-section, making it difficult to demonstrate the feasibility of space charge neutralization in a quadrupole trap. For this reason it was considered expedient to choose thallium iodide, which has a more favorable absorption spectrum (in the region of 2000 to 2100 A). The results indicate that, although the ionic recombination is a serious limiting factor, a considerable improvement can be obtained in practice for the density of trapped ions, with a considerable advantage in lifetimes for spectroscopic purposes. The ion pair formation by photoionization is briefly reviewed. Author

N73-10704# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Technische Physik.
APPLIED MAGNETOHYDRODYNAMICS. VOLUME 8: CHARACTERISTIC ANALYSES OF THE ELECTRON GAS EQUATION IN NONEQUILIBRIUM MAGNETOHYDRODYNAMICS
Gerhard Kolb Oct. 1971 44 p refs In GERMAN
(JUL-802-TP) Avail: AEC Depository Libraries

Characteristics of the general nonstationary electron gas equation of a noble gas-alkali plasma were studied in the pressure and temperature ranges applicable to MHD energy conversion. The equations appear as a system of elliptical, hyperbolic, and parabolic equations. Many conceivable mathematical simplifications used in the numerical treatment of 2-dimensional approximations are analyzed, and their properties are compared with the generalized system. Most significant is the problem of formulating boundary and initial conditions for the hyperbolic equations in such a way that solutions in the total range of definition become determined. Author (NSA)

N73-10705*# Commissariat a l'Energie Atomique, Limeil-Brevannes (France). Centre d'Etudes.
ELECTRONIC AND THERMODYNAMIC PROPERTIES OF THE TRANSITION BETWEEN METALLIC AND NONMETALLIC STATES IN DENSE MEDIA Ph.D. Thesis - Paris Univ., Orsay
Xavier Fortin Feb. 1972 113 p refs In FRENCH
(CEA-R-4268) Avail: AEC Depository Libraries

A theoretical determination, using hydrodynamic models, was made of the electronic and thermodynamic properties of dense plasma interactions with metallic and nonmetallic materials. Data also cover the effects of thermal excitation on the structure of the dense media and some of its physical characteristics. Transl. by E.H.W.

N73-10706# Air Force Weapons Lab., Kirtland AFB, N.Mex.
USER'S MANUAL: AFWL ONE-DIMENSIONAL PLASMA SIMULATION PARTICLE CODES Technical Report, Jan. 1971 - Mar. 1972
Brendon B. Godfrey, Clifford E. Rhoades, Jr., and Keith A. Taggart Apr. 1972 356 p
(AF Proj. 8809CF)
(AD-745423; AFWL-TR-72-47) Avail: NTIS CSCL 20/9

The report is intended primarily as a user's manual for a series of five computer codes for the numerical simulation of one-dimensional collisionless plasma phenomena. These codes solve, in effect, the one-dimensional Vlassov equation by following the trajectories of simulation particles under the influence of electromagnetic fields. Thus, the particle codes described are particularly useful for investigating micro-instabilities, such as those encountered in laser-plasma interactions, collisionless shocks, and plasma confinement. A discussion of numerical techniques is included. The report also includes a listing of the CDC FORTRAN 4 codes, including machine language subroutines for CDC 6000 and 7000 machines. The microfilm routines used to obtain phase space plots and energy graphs employ the system routine PLOTQ, designed specifically for the CDC 280 mirofilmer. Author (GRA)

N73-10707# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COLLECTIVE INTERACTIONS OF A HIGH CURRENT GAS DISCHARGE IN A PLASMA OF LOW DENSITY
M. M. Masud, M. E. Maznichenko, N. I. Reva, V. A. Suprunenko, E. A. Sukhomlin, A. M. Ternopol, and V. I. Tyupa 7 Mar. 1972 12 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 14, no. 11, 1969 p 1820-1824
(AD-745458; FTD-MT-24-1172-71) Avail: NTIS CSCL 20/9

Experimental results are presented concerning plasma instability occurring at the initial stage of the electrode plasma discharge when the plasma is rare. The collective processes are shown to be similar to those in case of interaction when injecting an external electron beam into plasma and differ greatly from

those occurring in a plasma of high density and high rate of ionization immersed in a strong electric field. The analysis of the experimental results suggests that the collective processes might have an important influence upon the breakdown mechanism of a neutral gas. Author (GRA)

N73-10708# Versar, Inc., Springfield, Va.
GAS EMBEDDED Z PINCH AND NUMERICAL SIMULATION OF HIGH DENSITY PLASMA DEVICES Final Report
D. A. Tidman Jun. 1972 45 p refs
(Contract N00014-71-C-0082)
(AD-745016) Avail: NTIS CSCL 20/9

The first six sections of the report summarize work on the gas-embedded z-pinch. Section 7 contains a description of work in progress to develop a numerical simulation of the lithium liner for the collapsing theta-pinch experiment (and other devices). Author (GRA)

N73-10709# Illinois Univ., Urbana. Coordinated Science Lab.
THE ION ACOUSTIC INSTABILITY IN THE HELIUM POSITIVE COLUMN
David Bentley Fenneman May 1972 110 p refs
(Contract DAAB07-67-C-0199)
(AD-745399; R-565; VILU-ENG-72-2226) Avail: NTIS CSCL 20/9

The theory of ion acoustic instability of the helium positive column in the pressure regime 0.050 to 0.250 Torr is developed, examined, and tested experimentally. Instability of the column is predicted by a kinetic theory which includes the effect of collisions with neutrals, but not by hydrodynamic theory. In the regime of the experiment, the ion acoustic instability is due to the resonant interaction of those electrons with velocities near the phase velocities of the ion acoustic waves (inverse Landau damping) even though the electron-neutral collision frequency exceeds the ion acoustic frequency. Author (GRA)

N73-10710# Physics International Co., San Leandro, Calif.
THEORETICAL STUDIES OF INTENSE RELATIVISTIC ELECTRON BEAM-PLASMA INTERACTIONS Final Report
Sidney Putnam Jul. 1972 389 p refs
(Contract DASA01-68-C-0096)
(AD-745369; PIFR-72-105; DNA-2849F) Avail: NTIS CSCL 20/9

A comprehensive survey of intense relativistic electron beam physics is presented, including detailed discussions of selected topics. The beam-generated plasma is characterized through charge production rules for calculation of gas breakdown times, conductivity at breakdown, and current neutralization. Longitudinal electrostatic instability theory is reviewed in the context of typical beam-plasma parameters and a model explaining the low-pressure transverse instability (the frozen hose) is given. Transport phenomenology without external fields and with external linear pinch and solenoidal fields is discussed and models are developed to define efficient beam transport conditions. Author (GRA)

N73-10711# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
EXPERIMENTAL STUDY OF INSTABILITIES IN THE ELMAX M.S. Thesis
Victor R. Trouy Jun. 1972 62 p refs
(AF Proj. 7073)
(AD-744818; GEP/PH/72-22) Avail: NTIS CSCL 20/9

An experimental search for instabilities in an ELMAX plasma device was made. Plasma generated oscillations of potential and density, with amplitudes several orders of magnitude above background noise, were observed over a wide range of plasma parameters. Measurements of plasma parameters were made with Langmuir probe diagnostic techniques. Frequencies from 3 kHz to 8 kHz were observed with phase velocity in the direction of the electron diamagnetic drift. Ion temperature was not measured and attempted measurements of space potential were not satisfactory. By comparing the observed characteristics of the oscillations with previously identified instabilities, the instabilities responsible for the plasma generated oscillations were tentatively identified as collisional drift waves. Author (GRA)

N73-10712# Naval Research Lab., Washington, D.C.
SOFT X-RAY EMISSION FROM DOUBLE ELECTRON RADIATIVE TRANSITIONS IN PLASMA IONS
R. C. Elton and L. J. Palumbo 29 Mar. 1972 18 p refs
(NRL Proj. H02-27C)
(AD-745736; NRL-MR-2457) Avail: NTIS CSCL 20/9

A broad emission blend was observed near 17 A from a plasma produced in a theta pinch deuterium discharge seeded with neon. The feature is associated with KL to the nth power yields L to the (m + 2) power + light where M greater than or = 6 double-electron radiative transitions resulting from the filling of a K-shell vacancy in the higher ionization species of the neon atoms by an L-shell electron, the simultaneous ionization (shake-off) or excitation (shake-up) of a second L-shell electron, and the emission of a photon. The observed spectral distribution of the blend was compared with the spectral distributions computed for various ion species by convoluting the instrument profile of the spectrograph with the predicted wavelengths and relative intensities of the shake-up lines and shake-off continua. A percentage probability for radiative Auger shake-off in agreement with theory was derived from the Ne VIII portion of the measured spectrum. The possibilities of such transitions for enhanced plasma cooling and for gain by stimulated emission are mentioned. Author (GRA)

N73-10713# Naval Postgraduate School, Monterey, Calif.
CONVERSION OF A TWO-DIMENSIONAL MAGNETOHYDRODYNAMIC COMPUTER CODE FROM CDC-6400 FORTRAN TO IBM 360/67 FORTRAN M.S. Thesis
Charles Stanley Yager, Jr. Jun. 1972 214 p refs
(AD-745854) Avail: NTIS CSCL 20/9

In a previous thesis a very general method for numerically solving two-dimensional, two-fluid magnetohydrodynamic equations was developed. A copy of the computer code was given to the Physics Department at the Naval Postgraduate School for conversion to the IBM 360/67 system presently in operation at the school. The paper is intended to be a users' manual for this code. Numerous changes to the original code were required due to the inherent differences between the CDC and IBM machines. The conversion of this code as well as a complete understanding of its operation and logic was the goal in the preparation of the paper. Author (GRA)

N73-10714# Pennsylvania Univ., Philadelphia. Towne School of Civil and Mechanical Engineering.
TRANSIENT CURRENT OVERSHOOT TO ELECTROSTATIC PROBES IN CONTINUUM SLIGHTLY IONIZED PLASMAS Interim Report
Ira M. Cohen Jun. 1972 21 p refs
(Grant NSF GK-2281)
(PB-210383; Rept-2281/7) Avail: NTIS HC $3.00 CSCL 20I

A spherical electrostatic probe in a collision-dominated, slightly ionized plasma biased at plasma potential was suddenly subjected to a transient potential ramp with rise time of the order of the electron diffusion time ((r sub p) squared/D(-), where (r sub p) is probe radius and D(-) is electron diffusion coefficient). After the rise, the final potential was maintained constant and small enough to admit a linearized analysis. It was found that the (electron) current overshot its final value by an amount proportional to the electron conductivity, and the overshoot phenomenon can be used as an additional diagnostic. Author (GRA)

N73-10715# Naval Research Lab., Washington, D.C.
DETERMINATION OF THE ELECTRON DENSITY PROFILE IN A LASER PLASMA BY STARK BROADENING OF SPECTRAL LINES
E. V. Aglitskii, V. A. Boiko, S. M. Zakharov, and G. V. Sklizkov 7 Jul. 1972 22 p refs Transl. into ENGLISH of Preprint 143, Akad. Nauk SSSR, Fiz. Inst., Moscow, 1970
(AD-746221; NRL-Trans-1253; Preprint-143) Avail: NTIS CSCL 20/9

Electron density measurements in a carbon plasma created by heating a solid target with about 1 GW emission from a glass laser were performed. The dependence of Ne on the distance from the target was determined by Stark broadening of H-like Carbon VI spectral lines in the vacuum and quartz ultraviolet regions. The Doppler shift of Carbon IV ion absorp-

tion lines (like Fraunhofer solar lines) permitted the measurement of the asymptotic gas-dynamic velocity of ion expansion. GRA

26 PHYSICS, SOLID STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N73-10716*# North Carolina State Univ., Raleigh. Solid State Device Lab.

THE ELECTRICAL PROPERTIES OF 60 keV ZINC IONS IMPLANTED INTO SEMI-INSULATING GALLIUM ARSENIDE

M. A. Littlejohn and Rangappan Anikara May 1972 66 p refs

(Grant NGL-34-002-098)

(NASA-CR-112199; SDL-15) Avail: NTIS HC $5.50 CSCL 20L

The electrical behavior of zinc ions implanted into chromium-doped semiinsulating gallium arsenide was investigated by measurements of the sheet resistivity and Hall effect. Room temperature implantations were performed using fluence values from 10 to the 12th to 10 to the 15th power/sq cm at 60 keV. The samples were annealed for 30 minutes in a nitrogen atmosphere up to 800 C in steps of 200 C and the effect of this annealing on the Hall effect and sheet resistivity was studied at room temperature using the Van der Pauw technique. The temperature dependence of sheet resistivity and mobility was measured from liquid nitrogen temperature to room temperature. Finally, a measurement of the implanted profile was obtained using a layer removal technique combined with the Hall effect and sheet resistivity measurements. Author

N73-10717*# North Carolina State Univ., Raleigh. Solid State Device Lab.

A STUDY OF THE ELECTRICAL PROPERTIES OF p-n JUNCTIONS FORMED BY ION-IMPLANTATION INTO GALLIUM ARSENIDE

Adrian Hsuan-Seus Lin Jun. 1972 116 p refs

(Grant NGL-34-002-098)

(NASA-CR-112200; SDL-17) Avail: NTIS HC $8.00 CSCL 20L

In the process of ion implantation, ion beams bombard the surface and create undesirable surface effects. The surface effects were investigated, and surface leakage currents were shown to be reduced by surface treatment. I-V characteristics and C-V measurements were obtained for the Zn-GaAs and Zn-(In,Ga)As junction is considered as a p-i-n heterojunction, without generation-recombination current. The Zn-GaAs junction is considered as a p-n homojunction with appreciable generation-recombination currents. Author

N73-10718# New South Wales Univ., Kensington (Australia). School of Electrical Engineering.

ELECTRON AND HOLE MOBILITIES IN SEMICONDUCTORS AT HIGH INJECTION LEVELS M.S. Thesis

M. S. Wells Jul. 1970 97 p refs

Avail: NTIS HC $7.00

The effects of electron-hole scattering on the mobility of carriers in silicon at high injected carrier densities were studied. Experimental results are presented showing the consequences of injected carrier densities exceeding 10 to the 16th power cu cm at room temperature, as encountered in semiconductor rectifiers or transistors, and thyristors carrying large currents. Measurements are shown of the variation of carrier lifetime with injected density, and the dependence of current on voltage in p-i-n rectifiers at high current levels in the forward direction. The sum of electron and hole mobilities, mu, was determined experimentally by measuring the conductivity, lifetime and carrier density in the 'i' region of a p-i-n structure for current densities varying from 0.01 A/sq cm up to 100 A/sq cm. The value of mu was found to decrease with increasing carrier density at room temperature. Author

N73-10719# Paris Univ. (France). Faculte des Sciences.

STUDY OF THE INFLUENCE OF HYDROSTATIC PRESSURE ON THE HIGH TEMPERATURE ELECTRICAL CONDUCTIVITY OF CRYSTALS OF LITHIUM FLUORIDE AND FLUORIDES OF ALKALINE EARTH METALS Ph.D. Thesis [ETUDE DE L'INFLUENCE D'UNE PRESSION HYDROSTATIQUE SUR LA CONDUCTIVITE ELECTRIQUE A HAUTE TEMPERATURE DE CRISTAUX DE FLUORURE DE LITHIUM ET DE FLUORURES DE METAUX ALCALINOTERREUX]

Michel Lallemand 1972 123 p refs In FRENCH

Avail: NTIS HC $8.25

Macroscopic models of quasi-chemical reactions, dielectric relaxation, and deformation energy are considered. The correlation between enthalpy values and activation volume is treated for various defect modes. The macroscopic variation of the volume of a crystal was obtained theoretically for the formation of a pair of intrinsic defects using atomic lattice theory. Elastic theory of continuous media was used to calculate the relaxation volume when the local values of the distortion parameters around an imperfection are known. Transl. by K.P.D.

N73-10720# Paris Univ. (France). Faculte des Sciences.

APPLICATION OF NONLINEAR THEORY OF THE FOURTH ORDER TO COMPRESSION SHOCK WAVES IN CRYSTALLINE SOLIDS WITH A CUBIC STRUCTURE Ph.D. Thesis [APPLICATION DE LA THEORIE NON LINEAIRE DU QUATRIEME ORDRE AUX ONDES DE CHOC DE COMPRESSION DANS LES SOLIDES CRISTALLINS A STRUCTURE CUBIQUE]

Michele Delannoy 1971 88 p refs In FRENCH

Avail: NTIS HC $6.50

Equations of state for solids are considered and a nonlinear theory of the fourth order was deduced. Its application of the study of compression shocks permits a fourth order Hugoniot curve to be plotted for each material. A method of calculating the temperature along the length of the experimental Hugoniot is presented. The calculations were carried out for five crystalline bodies: four metals with a cubic structure (aluminum, copper, silver, and sodium), and for monocrystalline periclase.

Transl. by K.P.D.

N73-10721# Stanford Univ., Calif. Dept. of Applied Physics.

MULTI-ION INTERACTIONS AND STRUCTURES IN SIMPLE METALS

Walter A. Harrison 6 Oct. 1972 27 p refs Submitted for publication

(Grant NSF GP-25945)

Avail: NTIS HC $3.50

The total energy of simple metals is calculated formally to all orders in the pseudopotential. The leading term (in the pseudopotential expansion) of the n-ion interaction is obtained from the nth order terms and the asymptotic form for large separations is evaluated explicitly. A three-body interaction is found to be strongest when the three ions form a straight line and are separated by nearest-neighbor distances. The assumption that the influence of d-state hybridization upon this interaction dominates the determination of structures leads to the correct distribution of cubic and hexagonal structures among the monovalent and divalent metals and to appropriate high and low axial ratios among the hexagonal structures. Author

N73-10722# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.

CALCULATION ASSISTED BY COMPUTER OF BEHAVIOR OF SEMICONDUCTOR DEVICES: APPLICATION TO THE BIPOLAR TRANSISTORS

D. Vandorpe, G. Merckel, and P. Saintot 26 Oct. 1971 30 p refs In FRENCH Presented at the Eurocon Computer Appl. Conf., Lausanne, 18-22 Oct. 1971

(CEA-CONF-1971; Conf-711011-3) Avail: AEC Depository Libraries.

A description is given of a one-dimensional model used with a computer to calculate the current flow behavior of integrated circuits in biopolar transistors. Program objectives were to: (1) develop a means by which fundamental physical phenomena may be understood, (2) establish a connection between device performance and technological characteristics, and (3) provide methods for optimizing the device. Transl. by E.H.W.

N73-10723# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
COMPUTER PROGRAM FOR SOLUTION OF DIFFUSION EQUATIONS FOR TWO IMPURITIES
J. Monnier, M. Maffei, M. Stern, and D. Vandorpe 27 Oct. 1971 44 p refs In FRENCH; ENGLISH summary Presented at Eurocon computer appl. Conf., Lausanne, Switzerland, 18-22 Oct. 1971
(CEA-CONF-1970; Conf-711011-2) Avail: AEC Depository Libraries

To make a connection between technological parameters and electrical models it is necessary to know with a good accuracy the shape of the diffusion profiles. For this reason, Fricks equations were solved taking into account almost all physical phenomena known for diffusion in semiconductors - presence of an oxide layer, point defect diffusion coefficient dependency impact of internal electric field, limited input flux, and segregation coefficient.
Author

N73-10724# Defence Research Information Centre, Orpington (England).
MOVEMENT OF THE 180 DEGREE DOMAIN BOUNDARY IN PEROVSKITE FERROELECTRICS
B. M. Darinskii and V. N. Fedosov May 1972 7 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR (Moscow), v. 135 no. 9, 1971 p 1795-1797
(AD-742109; DRIC-Trans-2767; BR-30141) Avail: NTIS CSCL 20/12

The calculation for constructing a 90 degree boundary was given in another paper by two of the authors. The microscopic expression for correlation energy, dependent on the elastrostatic interaction of dipoles in a Perovskite lattice was found. It was shown that the 90 degree boundary represents a region of sufficiently smooth transition of the vector of polarization of width in certain lattice constants. In this work an analogous problem was posed for the 180 degree boundary. In addition, the lattice potential topography along which the boundary moves during lateral displacement was determined. Author (GRA)

N73-10725# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
USING THE SPECIFIC HEAT METHOD TO STUDY VACANCIES
Yu. S. Nechaev 5 Apr. 1972 10 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), no. 4, 1970 p 138-141
(AD-743695; FTD-HC-23-85-72) Avail: NTIS CSCL 20/12

An analysis of heat capacity data for metals shows that in using the resistance of the sample to determine the high-temperature heat capacity and the contribution of the vacancies, the value of the equilibrium concentration of the vacancies can be increased 2-3 times and the relaxation time of the vacancies can be lowered several orders of magnitude. Such an error is not possible if the pulse and modulation methods are used in the relaxation variant with the given independent measurement.
Author (GRA)

N73-10726# Batelle Columbus Labs., Ohio.
PREPARATION AND PROPERTIES OF RARE-EARTH COMPOUNDS Semiannual Technical Report, 4 Jan. - 3 Jun. 1972
Van E. Wood, Kenneth C. Brog, Alfred E. Austin, James F. Miller, and William H. Jones, Jr. 30 Jun. 1972 54 p refs
(Contract DAAH01-70-C-1076; ARPA Order 1588)
(AD-744980) Avail: NTIS CSCL 20/12

The preparation and characterization and certain physical properties of some rare-earth compounds of technological potential are described. Magneto-ferroelectric materials and narrow-band narrow-gap semiconductors were investigated. In the former area, development of a simultaneously ferroelectric and ferromagnetic device element operating in a useful temperature range is the primary goal. The principal materials studied were bismuth-neodymium ferrites. It was found that addition of neodymium led to weak ferromagnetism at room temperature in the ferroelectric BiFeO3 phase. A nuclear-magnetic-resonance study of certain samarium monochalcogenides, which undergo semiconductor-to-metal transitions at elevated pressure, was carried out in order to determine the degree of localization of the samarium 4f states in these materials. Experiments on cathodoluminescence in these materials and further investigations of allegedly ferroelectric ytterbium chromite are also reported briefly.
Author (GRA)

N73-10727# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE QUESTION OF ac SUPERCONDUCTING POWER TRANSMISSION
E. N. Zuev 21 Apr. 1972 24 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Energ. i Transp. (Moscow), no. 1, 1971 p 45-54
(AD-745846; FTD-MT-24-1380-71) Avail: NTIS CSCL 09/1

The results of work on evaluating possible circuits and the electrical and dimensional characteristics of superconducting ac power transmission for the purpose of developing their possibilities in the transport of large amounts of power are presented. A method of calculating the fundamental electrical parameters and structural dimensions of lines with coaxial current-carrying elements taking into account a number of technical limitations, and especially the limitation of the power to be transmitted with the condition of steady-state stability is given. The question of reaching an optimum relationship between the powers which are maximum under the conditions of retaining the superconducting state and of the steady-state stability of power transmission is examined. Author (GRA)

N73-10728# Naval Postgraduate School, Monterey, Calif.
COMPUTER SIMULATION OF SPLIT INTERSTITIAL EQUILIBRIUM POSITIONS AND BINDING ENERGIES IN A TUNGSTEN CRYSTAL M.S. Thesis
James Anthony Tankovich Jun. 1972 69 p refs
(AD-745839) Avail: NTIS CSCL 20/2

Computer simulations were performed to locate the equilibrium positions and binding energies of interstitial He, Ne, Ar, Kr, and Xe in a tungsten crystal. Heavy interstitial atoms in tungsten share a lattice site with the atom that normally occupies that site and form what is called a split interstitial. Three characteristic interstitial sites were located relative to each lattice site tested. The distance of the impurity atom from the site was seen to vary roughly inversely with its mass, and the displacement of the lattice atom increased with the mass of the impurity atom. The foreign atom in its interstitial position was tested to determine the minimum initial kinetic energy needed to escape the lattice, as well as the optimum escape direction.
Author (GRA)

N73-10729# California Univ., Los Angeles. School of Engineering and Applied Science.
INVESTIGATION OF ULTRASONIC PROPAGATION IN FERROMAGNETIC MATERIALS Final Report
Richard Stern May 1972 13 p refs
(Contract N00014-69-A-0200-4018; NR Proj. 386-403)
(AD-745783; UCLA-ENG-7237) Avail: NTIS CSCL 20/12

A summary of the research performed under the contract is presented. Topics include: The rare earths; Ni3Al, superalloy; Third-order elastic constants; Acoustical instrumentation; and, Publications arising from the research program. GRA

N73-10730# Stanford Univ., Calif. Electronics Labs.
LARGE SIGNAL MODELING OF BIPOLAR TRANSISTORS FOR COMPUTER AIDED CIRCUIT ANALYSIS
Laurence Charles McBride Aug. 1971 121 p refs
(Contract N00014-67-A-0112-0038)
(AD-745772; SU-SEL-71-040; TR-4825-6) Avail: NTIS CSCL 09/1

Improved large-signal models for the bipolar transistor are derived which are suitable for dc and transient computer-aided circuit analysis. The models are developed from the results of a two-dimensional analysis which yields the normal-active dc characteristics of the intrinsic portion of the transistor. Each of the models is formulated in terms of a measurable set of parameters which can theoretically be related to the low-level electrical parameters of the transistor and hence to its basic geometrical and physical characteristics. Based upon the dc model, two transient models are derived which correspond to one- and two-section approximations to the distributed nature of the intrinsic base as seen from the emitter-base terminals. The primary

attribute of the single-section model, which corresponds in its complexity to commonly employed models, is its simplicity.
GRA

N73-10731# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTROSTRICTION IN FERROELECTRIC CERAMICS
T. N. Verbitskaya 27 Apr. 1972 13 p Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (USSR), v. 114, no. 3, 1957 p 533-536
(AD-745821; FTD-MT-24-1394-71) Avail: NTIS CSCL 20/12
The properties of barium titanate and of four materials based on solid solutions of Ba(Ti, Sn)O3 are examined. The coefficient of linear expansion of the materials is studied as a function of temperature and field intensity. Author (GRA)

N73-10732# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.
SOME ERRORS IN PEAK LOCATION IN X-RAY MEASUREMENTS OF RESIDUAL STRESS
R. H. Marion 1 Aug. 1972 23 p refs
(Contract N00014-67-A-0356-0008; NR Proj. 031-733; ONR Proj. 5345-444)
(AD-746488; TR-6) Avail: NTIS CSCL 20/2
Simple equations are presented for errors in determinations of residual stresses due to horizontal beam divergences, sample displacement from the 2 theta axis, and displacement of the axis of sample tilt from the 2 theta axis. Under good conditions, for steels, the error to be expected is plus or minus 1,500 psi.
Author (GRA)

N73-10733# Naval Postgraduate School, Monterey, Calif.
ACOUSTIC ENERGY FLOW IN HIGH SYMMETRY CRYSTALS M.S. Thesis
Herbert Carl Fauth Jun. 1972 39 p refs
(AD-745859) Avail: NTIS CSCL 20/12
The determination of elastic properties of crystals by sound velocity measurements is facilitated by use of a perturbation solution to the equations of motion for sound waves propagating in the crystals. Transformation equations can relate the solution for arbitrary propagation direction to an established crystal coordinate system. A method of calculating the acoustic components of the energy flow vector is developed for several high symmetry crystal classes. The validity of this method is herein confirmed and results are presented which are consistent with experimental data. A modern desk calculator was employed to determine solutions for hexagonal, cubic and tetragonal crystals. Author (GRA)

N73-10734# Army Foreign Science and Technology Center, Charlottesville, Va.
THERMOELECTRIC AND GALVANOMAGNETIC PROPERTIES OF (BiSb)(x)-(Pb)(1-x) ALLOYS
D. V. Gitsu and V. L. Sheinfeld 17 Apr. 1972 11 p refs Transl. into ENGLISH from Izv. Akad. Nauk Moldavsk. SSR, Ser. Fiz.-Tekhn. Mat. Nauk (Kishinev), no. 1, 1969
(AD-745865; FSTC-HT-23-341-72) Avail: NTIS CSCL 20/12
The study of the phenomena of alloy transference with impurities of quadri- and hexa-valent elements is highly useful, since in this way it is possible to compensate fully or partially for any holes or electrons, which to some extent facilitates the interpretation of experimental data. Such an approach to the problem presented has paramount practical significance, in particular for improvement of the thermoelectric quality of these alloys. Presented here are the results of investigation of galvanomagnetic and thermoelectric properties of monocrystalline alloys with lead content of up to 1.5 at %, in the main at the temperature of liquid nitrogen. The experiments were carried out on rectangular samples in which the second order axis or bisector axis is parallel to the main cleavage plane.
Author (GRA)

N73-10735# Aerospace Corp., El Segundo, Calif.
DETERMINATION OF DIFFUSION COEFFICIENTS IN SILICON AND ACCEPTED VALUES Technical Report, Apr. - Aug. 1970
Michael F. Millea 15 Apr. 1972 36 p refs
(Contract F04701-71-C-0172)
(AD-745945; TR-0172(9230-20)-4; SAMSO-TR-72-175) Avail: NTIS CSCL 20/12
The major emphasis of this review is directed towards a critical evaluation of experimentally determined diffusion coefficients of substitutional elements in silicon. A generalized definition of atomic migration is developed using the Onsager-Fuoss phenomenological approach and the conditions which must be satisfied when using Fick's first and second laws discussed. Various diffusion mechanisms are considered to illustrate possible interactions between crystal properties and atomic migration with special attention given to the effect of heavy doping and induced space-charge regions on diffusion. The effect of short-range solute-enhanced migration is also considered in discussing the effect of heavy doping on self-diffusion in silicon. The techniques commonly employed to determine atomic movement in silicon are presented. Author (GRA)

N73-10736# Brown Univ., Providence, R.I. Dept. of Physics.
ELECTROREFLECTANCE AND OTHER OPTICAL MODULATION STUDIES OF SOLIDS Final Report, 1 Apr. 1969 - 30 Jun. 1972
Phillip J. Stiles 30 Jun. 1972 10 p refs
(Contract DA-31-124-ARO(D)-454; DA Proj. 2O0-61102-B-11-B)
(AD-746271; AROD-6412-39-P) Avail: NTIS CSCL 20/12
Research was aimed at studies of optical properties and electronic band structure of solids. Topics included wavelength modulation spectroscopy, piezoreflectance, piezobirefringence and birefringence, model density of states and optical properties and raman spectroscopy. Author (GRA)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N73-10737*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DETERMINATION OF SOLID-PROPELLANT TRANSIENT REGRESSION RATES USING A MICROWAVE DOPPLER SHIFT TECHNIQUE
Leon D. Strand, August L. Schultz, and Gary K. Reedy 15 Oct. 1972 45 p refs
(Contract NAS7-100)
(NASA-CR-128393; JPL-TR-32-1569) Avail: NTIS HC $4.25 CSCL 21B
A microwave Doppler shift system, with increased resolution over earlier microwave techniques, was developed for the purpose of measuring the regression rates of solid propellants during rapid pressure transients. A continuous microwave beam is transmitted to the base of a burning propellant sample cast in a metal waveguide tube. A portion of the wave is reflected from the regressing propellant-flame zone interface. The phase angle difference between the incident and reflected signals and its time differential are continuously measured using a high resolution microwave network analyzer and related instrumentation. The apparent propellant regression rate is directly proportional to this latter differential measurement. Experiments were conducted to verify the (1) spatial and time resolution of the system, (2) effect of propellant surface irregularities and compressibility on the measurements, and (3) accuracy of the system for quasi-steady-state regression rate measurements.
Author

N73-10738*# Aerojet Solid Propulsion Co., Sacramento, Calif.
THE EFFECT OF SOLID PHASE REACTIONS ON THE BALLISTIC PROPERTIES OF PROPELLANTS
Willfred G. Schmidt Aug. 1972 84 p refs
(Contract NAS1-9463)
(NASA-CR-112083) Avail: NTIS HC $6.25 CSCL 21I
The combustion of NHClO4 composite propellants was studied between 15 and 3000 psi. The emphasis was on determining the mechanisms by which the fuel components influence the burning rate of the composites. All combustion experiments were performed with pressed powder strands. The fuels affected the combustion mechanism of the composite through their effect on

the oxidizer decomposition mechanism, the composite surface temperature, and by reacting heterogeneously with the oxidizer on the surface of the composite. The results indicate that the fuel component has a significant effect on the surface temperature in both catalyzed and uncatalyzed composites. The data suggest that the contribution, to the overall combustion reaction, of heterogeneous reactions increases with increasing pressure. There is also evidence that even in steady state combustion the ignition of individual oxidizer particles is an important parameter in determining the combustion characteristics of the composite.
Author

N73-10739# Naval Ordnance Lab., White Oak, Md.
EXPLOSIVE BEHAVIOR OF ALUMINIZED AMMONIUM PERCHLORATE
Donna Price, A. R. Clairmont, Jr., and J. O. Erkman 2 May 1972 82 p refs
(AD-745344; NOLTR-72-15) Avail: NTIS CSCL 21/9

Addition of aluminum to ammonium perchlorate (AP) increases its infinite diameter detonation velocity, decreases its critical diameter and (at sufficiently low% TMD) the Eyring reaction zone length. For 7-9 microns AP and 7 microns Al, the maximum of these effects occurred at about 10% Al. Regular detonation behavior could be observed only in the range of 55 to 40(or lower)% TMD. All mixtures tested in this range exhibited group 2 behavior as does AP itself. Author (GRA)

N73-10740# Rocketdyne, Canoga Park, Calif.
SOLID PROPELLANT COMBUSTION INSTABILITY SUPPRESSION DEVICES Final Report, 7 Dec. 1970 - 7 Oct. 1971
Carl L. Oberg, Ted L. Wong, William M. Burkes et al Edwards AFB, Calif. AFRPL Jun. 1972 228 p refs
(Contract F04611-71-C-0012)
(AD-743701; R-8822-1; AFRPL-TR-72-21) Avail: NTIS CSCL 21/9

A program has been performed to develop design criteria and design methods which may be used to ensure effective operational use of suppression devices to prevent acoustic modes of combustion instability in solid-propellant motors. The program comprised analytical studies and laboratory experimental studies, with T-burners and acoustic models being employed for the experimental work. Analytical studies of the stabilization processes brought about by the suppression devices have been performed. Problems relating to the manufacturing, durability, and installation are being investigated. Experimental studies of the stabilization processes have been made; acoustic models and a variation of the T-burner have been utilized for this purpose. Author (GRA)

N73-10741# Shell Development Co., Emeryville, Calif.
HYDROCARBON FUELS FOR ADVANCED SYSTEMS Annual Technical Report no. 3, 1 Sep. 1971 - 30 Apr. 1972
L. E. Faith, G. H. Ackerman, H. T. Henderson, A. W. Ritchie, and L. B. Ryland Wright-Patterson AFB, Ohio AFAPL Jul. 1972 176 p refs
(Contract F33615-70-C-1038; AF Proj. 3048)
(AD-746334; S-14127; AFAPL-TR-70-71-Pt-3) Avail: NTIS CSCL 21/4

The general objective was the development of new hydrocarbon fuels and new fuel systems which will meet the cooling and propulsion requirements of advanced air-breathing engines. Previous studies on the use of endothermic reactions of hydrocarbon fuels to cool advanced engines have shown the catalytic dehydrogenation of naphthenes to be very promising for practical applications. Catalysts were prepared for both packed bed and catalyst lined reactors, and their activity and stability for the dehydrogenation of methylcyclohexane were evaluated. An improved spherical catalyst and several catalyst lined reactors were tested. Kinetic models for the thermal reaction and catalytic dehydrogenation of methylcyclohexane were developed. Tests were continued to determine the effects of additives and the effects of different metal surfaces. Deposits from coker tests were measured. GRA

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N73-10742*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EUROPEAN AUXILIARY PROPULSION, 1972
L. B. Holcomb 1 Sep. 1972 43 p refs
(Contract NAS7-100)
(NASA-CR-128328; JPL-TM-33-555) Avail: NTIS HC $4.25 CSCL 21H

The chemical and electric auxiliary propulsion technology of the United Kingdom, France, and West Germany is discussed in detail, and the propulsion technology achievements of Italy, India, Japan, and Russia are reviewed. A comparison is presented of Shell 405 catalyst and a European spontaneous hydrazine catalyst called CNESRO I. Finally, conclusions are drawn regarding future trends in European auxiliary propulsion technology development.
Author

N73-10743*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPACE SIMULATION EXPERIMENTS ON REACTION CONTROL SYSTEM THRUSTER PLUMES
J. F. Cassidy 1972 10 p refs Presented at 8th Propulsion Specialists Conf., New Orleans, 29 Nov. - 1 Dec. 1972; sponsored by AIAA and SAE
(NASA-TM-X-68149; E-7176) Avail: NTIS HC $3.00 CSCL 21H

A space simulation procedure was developed for studying rocket plume contamination effects using a 5-pound bipropellant reaction control system thruster. Vacuum chamber pressures of 3 x 10 to the minus 5 torr (70 miles altitude) were achieved with the thruster firing in pulse trains consisting of eight pulses (50 msec on, 100 msec off, and seven minutes between pulse trains). The final vacuum was achieved by cooling all vacuum chamber surfaces to liquid helium temperature and by introducing a continuous argon leak of 48 std. cc/sec into the test chamber. An effort was made to simulate propellant system flow dynamics corresponding to actual spacecraft mission use. Fast time response liquid flow rate measurements showed that large variations occurred in the ratio of oxidizer to fuel flow for pulse-on times up to 120 msec. These variations could lead to poor combustion efficiency and the production of contamination. Author

N73-10744*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HYDROGEN-OXYGEN SPACE SHUTTLE ACPS THRUSTER TECHNOLOGY REVIEW
John W. Gregory and Paul N. Herr 1972 67 p refs Presented at 8th Propulsion Joint Specialists Conf., New Orleans, 29 Nov. - 1 Dec. 1972; sponsored by AIAA and SAE
(NASA-TM-X-68146; E-7171) Avail: NTIS HC $5.50 CSCL 21H

The generation of technology for injectors, cooled thrust chambers, valves, and ignition systems is discussed. The thrusters are designed to meet a unique and stringent set of requirements, including: long life for 100 mission reuses, high performance, light weight, ability to provide long duration firings as well as small impulse bits, ability to operate over wide ranges of propellant inlet conditions and to withstand reentry heating. The program has included evaluation of thrusters designed for ambient temperature and cold gaseous propellants at the vehicle interface. Author

N73-10745*# Gulf General Atomic, San Diego, Calif.
STUDY OF RADIOISOTOPE SAFETY DEVICES FOR ELECTRIC PROPULSION SYSTEM, VOLUME 1: SUMMARY REPORT
G. B. Bradshaw, W. G. Homeyer, F. D. Postula, and E. J. Steeger 6 Oct. 1972 25 p ref 3 Vol.
(Contract NAS2-5891; GGA Proj. 2113)
(NASA-CR-114505; Gulf-GA-A12242-Vol-1) Avail: NTIS HC $3.25 CSCL 21C

A new reference design was prepared for the 5 kW(e) thermionic power supply. The safety equipment in this design is a passive containment system which does not rely on the operation of any mechanisms such as a launch escape rocket or deployment

of parachutes. It includes: (1) a blast shield to protect against the explosion of the launch vehicle; (2) a combination of refractory thermal insulation and heat storage material to protect against a sustained launch pad fire; (3) a reentry body with a spherical nose and a large conical flare at the aft end to stabilize the reentry attitude and lower the terminal velocity in air; (4) composite graphite thermal protection to sustain the reentry heat pulse; (5) crushable honeycomb behind the nose to limit the deceleration of the radioisotope source due to impact on land at terminal velocity; (6) a double-walled secondary containment vessel surrounding the isotopic capsules; (7) neutron shielding to reduce external dose rates; (8) an auxiliary cooling system employing redundant heat pipes to remove the radioactive decay heat from the heat source and reject it to the surroundings or to a forced convection loop. Author

N73-10746*# Gulf General Atomic, San Diego, Calif.
STUDY OF RADIOISOTOPE SAFETY DEVICES FOR ELECTRIC PROPULSION SYSTEM, VOLUME 2: FINAL REPORT
G. B. Bradshaw, W. G. Homeyer, F. D. Postula, and E. J. Steeger 6 Oct. 1972 148 p refs 3 Vol.
(Contract NAS2-5891)
(NASA-CR-114506; Gulf-GA-A12242-Vol-2) Avail: NTIS HC $9.50 CSCL 21C
For abstract see N73-10745

N73-10747*# Gulf General Atomic, San Diego, Calif.
STUDY OF RADIOISOTOPE SAFETY DEVICES FOR ELECTRIC PROPULSION SYSTEM, VOLUME 3: BRIEFING AND REVIEW OF WORK
G. B. Bradshaw, W. G. Homeyer, F. D. Postula, and E. J. Steeger Sep. 1972 87 p 3 Vol.
(Contract NAS2-5891)
(NASA-CR-114507; Gulf-GA-A12242-Vol-3) Avail: NTIS HC $6.50 CSCL 21C
For abstract see N73-10745

N73-10748# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Luftsaugende Antriebe.
INVESTIGATIONS OF THE IGNITION AND FLAME STABILIZATION IN A RAMJET ENGINE [VERSUCHE ZUR ZUENDUNG UND FLAMMENSTABILISIERUNG IN EINEM STAUSTRAHLTRIEBWERK]
Reiner Lindemann Jun. 1972 25 p refs In GERMAN; ENGLISH summary
(DLR-FB-72-47) Avail: NTIS HC $3.25; DFVLR, Porz: 8,50 DM

Tests were carried out in the DFVLR propulsion wind tunnel in which a kerosene ramjet was ignited by the jet of an integrated gas generator using different combustion chamber configurations. A hot gas jet of sufficient performance will affect combustion in the chamber in such a way that flameholder elements could be diminished or omitted. The chamber structure may be reduced and the resulting lower amount of chamber pressure loss may increase engine performance. The first results show a broadening of the smooth burning range. Author (ESRO)

N73-10749# Army Logistics Management Center, Fort Lee, Va.
DOD AIRCRAFT ENGINE REQUIREMENTS STUDY Final Report
W. Karl Kruse Mar. 1972 45 p refs
(AD-745396) Avail: NTIS CSCL 21/5

The report investigates two questions posed by the DOD task group on aircraft engine requirements. The first question concerned whether the Poisson distribution as used by the DOD stockage methodology was valid. Analysis of Air Force removal data indicated that it is not. The second question was whether a better stockage computation methodology than the DOD methodology existed. While no definite conclusion could be drawn, attempts to answer the question indicated the importance of recognizing and accounting for forecast error in the methodology. Author (GRA)

N73-10750# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
A REVIEW OF CURRENT AND PROJECTED ASPECTS OF TURBINE ENGINE PERFORMANCE EVALUATION Technical Report, Jul. 1968 - Dec. 1970
Robert J. May, Jr., Barry J. Brownstein, Stephen J. Przybylko, Richard L. McTasney, and Anthony T. Molisse Feb. 1972 117 p refs
(AF Proj. 3066)
(AD-744587; AFAPL-TR-71-34) Avail: NTIS CSCL 21/5

The report is a compilation of four separate papers which, in total, represent a survey of several important aspects of turbine engine performance analysis. The first paper describes a digital computer method which has become a powerful tool for simulation of steady-state engine operation. A discussion of inlet airflow distortion is the topic of the second paper. It elaborates on a theory of rotating stall generation and a unique method which was encountered for determining how this distortion propagates through the compression components and produces surge. The third paper addresses the problems associated with the engine control system and the techniques for computer simulation of transient engine operation. A discussion of the performance predictions of complex multimission aircraft weapon systems comprise the final section of this technical report. Author (GRA)

N73-10751# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DESIGN AND STRESS ANALYSIS OF EXTRATERRESTRIAL ELECTRIC ROCKET ENGINES
A. F. Gurov, D. D. Sevruk, and D. N. Sumov 27 Apr. 1972 672 p refs Transl. into ENGLISH of "Konstruktsiya i Raschet na Prochnost Kosmicheskikh Elektroakeynykh Dvigatelei" Moscow, Masgiz., 1970 p 1-491
(AD-745427; FTD-MT-24-1462-71) Avail: NTIS CSCL 21/3

Given are general data on the design of electric rocket engines calculation of their strength and vibrations, and evaluation of their reliability. Considerable attention is given to power generators of cosmic engine installations. Analyzed are structural diagrams of nuclear reactors, isotopic power supply sources, solar concentrators and chemical fuel elements. Given are methods for calculation of strength of various generator parts, housings, casings, and walls, perforated plates under load. Discussed is the calculation of temperature stresses in heat-releasing reactor elements. Author (GRA)

N73-10752# Army Air Mobility Research and Development Lab., Fort Eustis, Va. Eustis Directorate.
STATIC, BALLISTIC, AND IMPACT BEHAVIOR OF GLASS/GRAPHITE DRIVE SHAFTING
I. E. Figge, Sr. Jun. 1972 20 p refs
(AD-743938; USAAMRDL-TM-1) Avail: NTIS CSCL 21/5

Limited static tests on damaged scale-model HLH 4.5-inch-diameter plus or minus 45 degrees glass/plus or minus 5 degrees graphite drive shaft sections at 150F indicated that the shafts are not capable of meeting the design requirement of the HLH. Low-energy impacts (ball drops) produced catastrophic brittle failure of the graphite material. Ballistic damage was localized to the impact area but resulted in a strength reduction factor of approximately 1.75. Author (GRA)

N73-10753# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN INVESTIGATION OF THE DETECTION OF CHARGED METAL PARTICLES IN A JET ENGINE EXHAUST BY A CYLINDRICAL ELECTROSTATIC PROBE M.S. Thesis
Ray W. Burgess, Jr. Jun. 1972 86 p refs
(AD-745540; GEP/PH/72-2) Avail: NTIS CSCL 21/5

Charged particle detection by an electrostatic probe in a jet engine is studied from both a theoretical and an experimental approach. The charging mechanisms for a metal particle in a jet engine exhaust are presented and discussed. A theory for the waveshape expected for a charged metal particle moving perpendicular to a cylindrical electrostatic probe is developed. The theory is developed using an electronic circuit equivalent to the physical mechanisms in the jet engine. A laboratory burner is described which simulates the exhaust ion number density and lower thrust values of a jet engine. Experimental data are presented for the burner and for a scaled up system which

uses a 0.44 cm diameter particle, a 7.6 cm diameter probe, and a 30 cm/sec velocity. Author (GRA)

N73-10754# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INFLUENCE OF THE COOLING AIR EXHAUST METHOD ON THE EFFECTIVENESS OF COOLING OF THE TRAILING EDGES OF GAS TURBINE BLADES
L. M. Ronkin 27 Apr. 1972 10 p refs Transl. into ENGLISH from Energomashinestroenie (Moscow), v. 17, 1971 p 47-48
(AD-745834; FTD-HT-23-396-72) Avail: NTIS CSCL 21/5

Blades of the same profile, with a deflector ensuring transverse flow in the blade cavity from the leading to the trailing edge were tested to study the cooling characteristics of several types of air exhaust with respect to the trailing edges of the blades. Best trailing edge cooling was obtained with blades where the cooling air is exhausted directly into the ring clearance. Author (GRA)

N73-10755# Naval Postgraduate School, Monterey, Calif.
CONVERSION OF INLET TEMPERATURE DISTORTIONS TO VORTICITY FOR AN AXIAL-FLOW COMPRESSOR M.S. Thesis
Michael Martin Iverson Jun. 1972 92 p refs
(AD-745852) Avail: NTIS CSCL 21/5

A survey of the literature on pressure, temperature and foreign gas inlet distortions is made. For interpretation of the influence of inlet distortion on engine stability, a break is made with distortion methods which use temperature or pressure distortion maps. The distortion in the form of temperature contours is transformed to vorticity using appropriate equations derived for both incompressible and compressible flow. A numerical solution of Poisson's equation to describe secondary flow arising from convected vorticity is presented. Author (GRA)

N73-10756# Dayton Univ. Research Inst., Ohio.
COMPUTER PROGRAMS FOR SINGLE STAGE AXIAL COMPRESSOR TEST DATA ANALYSIS. VOLUME 1: THEORY, DESCRIPTIONS, AND USERS INSTRUCTIONS Final Technical Report, 16 Jun. 1971 - 17 Apr. 1972
Richard M. Hearsey Wright-Patterson AFB, Ohio AFAPL Jun. 1972 95 p refs
(Contract F33615-71-C-1751; AF Proj. 3066; AF Proj. 7065)
(AD-744502; UDRI-TR-72-20-Vol-1; AFAPL-TR-72-43-Vol-1) Avail: NTIS CSCL 21/5

A pair of special-purpose computer programs have been written for the analysis of axial compressor aerodynamic test data. The axisymmetric flow of a thermally-perfect compressible fluid is assumed, and the streamline curvature method of solution is employed. By optionally incorporating details of the blade geometry in the input data, a detailed account of the flow through the blading may be obtained. A unique feature of the analysis is the option to determine annulus blockage due to boundary layers and blade wakes by utilizing experimental wall static pressure readings in addition to the usual traverses of total pressures and temperatures. This first volume of two that describe the programs fully details the theory of the method, describes the computer programs, and gives all information necessary to use them. Author (GRA)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

N73-10757# Institut d'Aeronomie Spatiale de Belgique, Brussels.
STRATOSPHERIC METHANE FROM INFRARED SPECTRA
M. Ackerman and C. Muller 1972 14 p refs
(Aeronomica-Acta-A-105) Avail: NTIS HC $3.00

Solar spectra recorded by means of a balloon-borne spectrometer over the 3 to 4 micron range at solar zenith angles between 75 deg and 95 deg from an altitude of 34 km are presented. The mixing ratio of methane between 16 and 33 km which is deduced from the measurements decreases in the stratosphere. These observational results confirm the conclusion drawn from sampling experiments made by Bainbridge and Heidt up to 23 km and show that the mixing ratio decreases by a factor of about 3 between the tropopause at 13.5 km and the altitude of 33 km in the stratosphere. Author

N73-10758# Atomic Energy of Canada Ltd., Chalk River (Ontario).
COSMIC RAY IGY NEUTRON MONITOR DATA, 3, FROM DEEP RIVER, ONTARIO AND MONTHLY GRAPHS, JANUARY - DECEMBER 1960
J. F. Steljes May 1972 72 p refs
(AECL-4209) Avail: NTIS; Atomic Energy of Can., Ltd., Chalk River: $2.00

Uncorrected and barometer-corrected hourly rates from Deep River are given in tabular form for the period from January 1960 to December 1960. The barometer-corrected data are normalized to remove the effects of changes of efficiency and are compatible with the results of the 48-NM-64 monitor. Graphs of the corrected data are given. Author

N73-10759# Osservatorio Astronomico, Roma (Italy).
SOLAR PHENOMENA, JULY 1972
Massimo Cimino Jul. 1972 17 p
(Bull-171) Avail: NTIS HC $3.00

Tabulated data of diurnal variations of sunspot phenomena are presented for June and July 1972. The data include daily total areas of sunspot groups; heliographic position, classification, and area of sunspot groups; hours of K-line cinematographic patrol; and hours of H alpha cinematographic patrol Charts of longitudinal sunspot magnetic fields are also included. N.E.N.

N73-10760*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SOLAR WIND
C. P. Sonett, ed., Paul J. Coleman, Jr., ed., and John M. Wilcox, ed. Washington 1972 728 p refs Proc. of conf. held at Pacific Grove, Calif., 21-26 Mar. 1971
(NASA-SP-308; LC-72-600187) Avail: NTIS; SOD $6.00 CSCL 03B

A series of conference papers is presented on solar wind and interplanetary magnetic structure and behavior. Specific data are given on solar wind plasma, the relationship of solar and stellar angular momentum to the solar wind, and spacecraft and ground observations of the solar wind. For individual titles, see N73-10761 through N73-10816.

N73-10761* Hale Observatories, Pasadena, Calif.
PHOTOSPHERIC MAGNETIC FIELDS
Robert Howard (Carnegie Inst. of Wash.) *In* NASA. Ames Res. Center Solar Wind 1972 p 3-10 refs (For availability see N73-10760 01-29)
CSCL 03B

Knowledge on the nature of magnetic fields on the solar surface is reviewed. At least a large part of the magnetic flux in the solar surface is confined to small bundles of lines of force within which the field strength is of the order of 500 gauss. Magnetic fields are closely associated with all types of solar activity. Magnetic flux appears at the surface at the clearly defined birth or regeneration of activity of an active region. As the region ages, the magnetic flux migrates to form large-scale patterns and the polar fields. Some manifestations of the large-scale distribution are discussed. Author

N73-10762* High Altitude Observatory, Boulder, Colo.
CORONAL MAGNETIC FIELDS AND THE SOLAR WIND
Gordon Newkirk, Jr. *In* NASA. Ames Res. Center Solar Wind 1972 p 11-30 refs (For availability see N73-10760 01-29)
CSCL 03B

Current information is presented on coronal magnetic fields as they bear on problems of the solar wind. Both steady state fields and coronal transient events are considered. A brief critique is given of the methods of calculating coronal magnetic fields including the potential (current free) models, exact solutions for the solar wind and field interaction, and source surface models. These solutions are compared with the meager quantitative observations which are available at this time. Qualitative comparisons between the shapes of calculated magnetic field lines and the forms visible in the solar corona at several recent

eclipses are displayed. These suggest that: (1) coronal streamers develop above extended magnetic arcades which connect unipolar regions of opposite polarity; and (2) loops, arches, and rays in the corona correspond to preferentially filled magnetic tubes in the approximately potential field. Author

N73-10763* Ceskoslovenska Akademie Ved, Ondrejov. Observator.
LARGE-SCALE NEGATIVE POLARITY MAGNETIC FIELDS ON THE SUN AND PARTICLE-EMITTING FLARES
V. Bumba *In* NASA. Ames Res. Center Solar Wind 1972 p 31-43 refs (For availability see N73-10760 01-29)
CSCL 03B

Some observational facts about the large-scale patterns formed by solar negative polarity magnetic fields during the 19th and 20th cycles of solar activity are presented. The close relation of the position of occurrence of very large flares accompanied by cosmic ray and PCA events as well as other phenomena of solar activity during the declining part of the 19th cycle of the regularities in the internal structure of large scale negative polarity features are demonstrated. Author

N73-10764* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CURRENT SHEET MAGNETIC MODEL FOR THE SOLAR CORONA
Kenneth H. Schatten *In its* Solar Wind 1972 p 45-54 refs (For availability see N73-10760 01-29)
CSCL 03B

A new magnetic model is developed and compared with previous models and the observed solar corona. An attempt is made to more accurately compute the three-dimensional currents flowing in the solar corona. Physical reasons are given that require most of the large scale currents flowing in the solar corona to lie near thin sheets. The current sheets are not constrained into any particular geometry or symmetry as in the previous models of Altschuler and Newkirk (1969) and Schatten et al. (1969). A comparison with the axisymmetric, isothermal MHD solution of Pneuman and Kopp (1970) suggests that the model is able to simulate to high accuracy an isothermal corona. A comparison of the model with the May 30, 1965, solar eclipse and the November 12, 1966, solar eclipse shows the model is capable of computing many features including the polar plume orientations as well as radial and nonradial streamers in the solar corona. Author

N73-10765* High Altitude Observatory, Boulder, Colo.
STRUCTURE OF CORONAL NEUTRAL SHEETS
G. W. Pneuman *In* NASA. Ames Res. Center Solar Wind 1972 p 55-62 refs Sponsored by NSF (For availability see N73-10760 01-29)
CSCL 03B

A qualitative model for the structure of the neutral sheet lying along the axis of coronal streamers is developed. The internal topology of the sheet is that of extremely thin magnetic tongues greatly distended outward by the solar wind expansion inside the sheet. Due to finite conductivity effects, expansion is taking place across the field lines but is retarded relative to the external flow by the reverse jxB force. The sheet thickness is determined by three considerations: the electrical conductivity that specifies the magnitude of the gradients in field strength, the expansion velocity that stretches the field lines outward decreasing the sheet thickness, and finally, the lateral pressure balance that limits the approach of the oppositely directed external field toward the neutral plane. If sigma is the electrical conductivity, the sheet thickness is shown to be proportional to sigma-1/3. For an electron conductivity evaluated perpendicular to the internal field in the sheet, the thickness is of the order of 100 km in the inner corona and 10,000 km at 1 AU. Microturbulence and instabilities are expected to yield dimensions greater than these theoretical values since these effects tend to reduce the effective conductivity. Author

N73-10766* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LARGE-SCALE PROPERTIES OF THE INTERPLANETARY MAGNETIC FIELD
Kenneth H. Schatten *In its* Solar Wind 1972 p 65-92 refs (For availability see N73-10760 01-29)
CSCL 03B

Early theoretical work of Parker is presented along with the observational evidence supporting his Archimedes spiral model. Variations present in the interplanetary magnetic field from the spiral angle are related to structures in the solar wind. The causes of these structures are found to be either nonuniform radial solar wind flow or the time evolution of the photospheric field. Coronal magnetic models are related to the connection between the solar magnetic field and the interplanetary magnetic field. Direct extension of the solar field-magnetic nozzle controversy is discussed along with the coronal magnetic models. Effects of active regions on the interplanetary magnetic field is discussed with particular reference to the evolution of interplanetary sectors. Interplanetary magnetic field magnitude variations are shown throughout the solar cycle. The percentage of time the field magnitude is greater than 10 gamma is shown to closely parallel sunspot number. The sun's polar field influence on the interplanetary field and alternative views of the magnetic field structure out of the ecliptic plane are presented. In addition, a variety of significantly different interplanetary field structures are discussed. Author

N73-10767* California Inst. of Tech., Bishop.
THE INTERPLANETARY MAGNETIC FIELD
Leverett Davis, Jr. *In* NASA. Ames Res. Center Solar Wind 1972 p 93-114 refs (For availability see N73-10760 01-29) (Grant NGR-05-002-160)
CSCL 03B

Large-scale properties of the interplanetary magnetic field as determined by the solar wind velocity structure are examined. The various ways in which magnetic fields affect phenomena in the solar wind are summarized. The dominant role of high and low velocity solar wind streams that persist, with fluctuations and evolution, for weeks or months is emphasized. It is suggested that for most purposes the sector structure is better identified with the stream structure than with the magnetic polarity and that the polarity does not necessarily change from one velocity sector to the next. Several mechanisms that might produce the stream structure are considered. The interaction of the high and low velocity streams is analyzed in a model that is steady state when viewed in a frame that corotates with the sun. Author

N73-10768* High Altitude Observatory, Boulder, Colo.
THE ELECTROMAGNETIC STRUCTURE OF INTERPLANETARY SPACE
Jan Olof Stenflo *In* NASA. Ames Res. Center Solar Wind 1972 p 115-118 refs Sponsored by NSF (For availability see N73-10760 01-29)
CSCL 03B

A method to calculate the three-dimensional structure of the interplanetary magnetic field is presented. The integrations are based on magnetograph recordings of longitudinal magnetic fields in the solar photosphere. The program by Altschuler and Newkirk is used to calculate the radial component of the magnetic field on the source surface, situated at r = 2.6r. This determines the inner boundary conditions for the integration outwards of the interplanetary field equations by means of the method that is described. Computer-drawn plots of the interplanetary field lines out to the earth's orbit are presented for the periods around the total solar eclipses of November 12, 1966, and March 7, 1970. During the former period the interplanetary field exhibited a clean, dipole-type structure, while during the latter period the field was more complicated and had four sectors in the equatorial plane. A movie was presented, showing how the interplanetary field structure rotates as seen by a magnetometer in the sun's equatorial plane. Author

N73-10769* Centre National de la Recherche Scientifique, Meudon (France). Observatoire.
HELMET AND ACTIVE STREAMERS FROM RADIO OBSERVATIONS
Y. Avignon, F. Axisa (Centre d'Etudes Nucl. de Saclay, France. Serv. d'Electron. Phys.), M. J. Martres, M. Pick, and P. Simon *In* NASA. Ames Res. Center Solar Wind 1972 p 119-121 refs (For availability see N73-10760 01-29)
CSCL 03B

Large coronal regions disconnected from any calcium plages

and identified by their thermal emission at 169 mHz play a basic role in the sector structure of the interplanetary medium. It was concluded that these coronal regions are to be interpreted as streamers. Author

N73-10770* Brigham Young Univ., Provo, Utah. Dept. of Physics and Astronomy.
THE INTERPLANETARY AND SOLAR MAGNETIC FIELD SECTOR STRUCTURES, 1962 - 1968
Douglas E. Jones *In* NASA. Ames Res. Center Solar Wind 1972 p 123-135 refs (For availability see N73-10760 01-29) (Grant NGR-45-001-011)
CSCL 03B

The interplanetary magnetic field sector structure was observed from late 1962 through 1968. During this time it has been possible to study the manner in which the sector pattern and its relation to the photospheric magnetic field configuration changes from solar minimum to solar maximum. Observations were also made relating sector boundaries to specific regions on the solar disk. These and other observations related to the solar origin of the interplanetary field are briefly reviewed. Author

N73-10771* National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
LARGE-SCALE SOLAR MAGNETIC FIELDS AND H-ALPHA PATTERNS
Patrick S. McIntosh *In* NASA. Ames Res. Center Solar Wind 1972 p 136-150 refs (For availability see N73-10760 01-29)
CSCL 03B

Coronal and interplanetary magnetic fields computed from measurements of large-scale photospheric magnetic fields suffer from interruptions in day-to-day observations and the limitation of using only measurements made near the solar central meridian. Procedures were devised for inferring the lines of polarity reversal from H-alpha solar patrol photographs that map the same large-scale features found on Mt. Wilson magnetograms. These features may be monitored without interruption by combining observations from the global network of observatories associated with NOAA's Space Environment Services Center. The patterns of inferred magnetic fields may be followed accurately as far as 60 deg from central meridian. Such patterns will be used to improve predictions of coronal features during the next solar eclipse. Author

N73-10772* Ceskoslovenska Akademie Ved, Ondrejov. Observator.
SOLAR LARGE-SCALE POSITIVE POLARITY MAGNETIC FIELDS AND GEOMAGNETIC DISTURBANCES
V. Bumba *In* NASA. Ames Res. Center Solar Wind 1972 p 151-157 (For availability see N73-10760 01-29)
CSCL 03B

Unlike the negative polarity solar magnetic field large-scale regular features that correlate with enhanced solar activity regions, the positive polarity regular formations formed in the weak and old background magnetic fields seem to correlate well with geomagnetically enhanced periods of time (shifted for 4 days), which means that they seem to be the source of the quiet solar wind. This behavior of the large intervals of heliographic longitude with prevailing positive polarity fields may be followed to the end of the 18th cycle, during the declining part of the 19th cycle, and during the first half of the present 20th cycle of solar activity. Author

N73-10773* Chicago Univ., Ill. Dept. of Physics.
PRESENT DEVELOPMENTS IN THEORY OF THE SOLAR WIND
E. N. Parker *In* NASA. Ames Res. Center Solar Wind 1972 p 161-169 refs (For availability see N73-10760 01-29) (Grant NGL-14-001-001)
CSCL 03B

Current problems and developments in the theory of the large-scale expansion of the solar corona are reviewed. The outstanding question is whether the energy supply to the quiet corona is mainly thermal conduction outward from a region of active heating at its base, or mainly wave propagation outward from the base. It is suggested that the question can be settled only when the properties of the wind can be sampled over a wide range of radial distance from the sun, from far inside the orbit of earth to well beyond. It was suggested that hydromagnetic waves may drive the expansion of the active corona by direct transfer of momentum as well as energy. Author

N73-10774* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE LARGE-SCALE STRUCTURE OF THE SOLAR WIND
John H. Wolfe *In its* Solar Wind 1972 p 170-201 refs (For availability see N73-10760 01-29)
CSCL 03B

The large-scale structure of the solar wind is reviewed on the basis of experimental space measurements acquired over approximately the last decade. The observations cover the fading portion of the last solar cycle up through the maximum of the present cycle. The character of the interplanetary medium is considered from the viewpoint of the temporal behavior of the solar wind over increasingly longer time intervals, the average properties of the various solar wind parameters and their interrelationships. Interplanetary-terrestrial relationships and the expected effects of heliographic lattitude and radial distance are briefly discussed. Author

N73-10775* High Altitude Observatory, Boulder, Colo.
TEMPORAL EVOLUTION OF VELOCITY STRUCTURES IN THE SOLAR WIND
J. T. Gosling *In* NASA. Ames Res. Center Solar Wind 1972 p 202-207 refs Sponsored by NSF (For availability see N73-10760 01-29)
CSCL 03B

Generally poor correlations were obtained of solar wind flow speed measurements at one point in the ecliptic plane with measurements at the same point 28 days (one solar rotation) earlier or with measurements at other points in the ecliptic plane separated by 50 deg or more in solar longitude. This is evidence that either the flow speed is a very sensitive function of solar latitude or that temporal processes typically alter the speed of the wind emanating from particular solar regions on a time scale of about 4 days. From a measure of the persistence of the flow speed at the orbit of the earth, it appears that the temporal explanation is more likely to be the correct one. Author

N73-10776* Los Alamos Scientific Lab., N.Mex.
AVERAGE THERMAL CHARACTERISTICS OF SOLAR WIND ELECTRONS
Michael D. Montgomery *In* NASA. Ames Res. Center Solar Wind 1972 p 208-218 refs Sponsored by ARPA, AEC, and AF (For availability see N73-10760 01-29)
CSCL 03B

Average solar wind electron properties based on a 1 year Vela 4 data sample from May 1967 to May 1968 are presented. Frequency distributions of electron-to-ion temperature ratio, electron thermal anisotropy, and thermal energy flux are presented. The resulting evidence concerning heat transport in the solar wind is discussed. Author

N73-10777* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MODEL FOR ENERGY TRANSFER IN THE SOLAR WIND: MODEL RESULTS
Aaron Barnes and R. E. Hartle *In its* Solar Wind 1972 p 219-226 refs (For availability see N73-10760 01-29)
CSCL 03B

A description is given of the results of solar wind flow in which the heating is due to (1) propagation and dissipation of hydromagnetic waves generated near the base of the wind, and (2) thermal conduction. A series of models is generated for fixed values of density, electron and proton temperature, and magnetic field at the base by varying the wave intensity at the base of the model. This series of models predicts the observed correlation between flow speed and proton temperature for a large range of velocities. The wave heating takes place in a shell about the sun greater than or approximately equal to 10 R thick. We conclude that large-scale variations observed in the solar wind are probably due mainly to variation in the hydromagnetic wave flux near the sun. Author

N73-10778* California Univ., Los Angeles. Dept. of Planetary and Space Science.

MAGNETIC LATITUDE EFFECTS IN THE SOLAR WIND

C. Richard Winge, Jr. and Paul J. Coleman, Jr. *In* NASA. Ames Res. Center Solar Wind 1972 p 227-231 refs (For availability see N73-10760 01-29)
(Grant NGR-05-007-065)
CSCL 03B

The Weber-Davis model of the solar wind is generalized to include the effects of latitude. The principal assumptions of high electrical conductivity, rotational symmetry, the polytropic relation between pressure and density, and a flow-alined field in a system rotating with the sun, are retained. An approximate solution to the resulting equations for spherical boundary conditions at the base of the corona indicates a small component of latitudinal flow toward the solar poles at large distances from the sun as result of latitudinal magnetic forces. Author

N73-10779* National Center for Atmospheric Research, Boulder, Colo.

TRANSITION FROM A SUPERSONIC TO A SUBSONIC SOLAR WIND

B. Durney *In* NASA. Ames Res. Center Solar Wind 1972 p 232-235 refs Sponsored by NSF (For availability see N73-10760 01-29)
CSCL 03B

The transition from a supersonic to a subsonic corona was investigated by increasing the density N sub O at the base of the corona while keeping the temperature T sub O constant. For the initial values of N sub O and T sub O, the solution of the inviscid solar wind equations is of the Parker type. As N sub O is increased, Parker type supersonic solutions cease to exist. No subsonic solutions exist. Author

N73-10780* Catholic Univ. of America, Washington, D.C. Dept. of Aerospace and Atmospheric Sciences.

CONVERSION OF MAGNETIC FIELD ENERGY INTO KINETIC ENERGY IN THE SOLAR WIND

Y. C. Whang *In* NASA. Ames Res. Center Solar Wind 1972 p 236-243 refs (For availability see N73-10760 01-29)
(Grant NGR-09-005-063)
CSCL 03B

The outflow of the solar magnetic field energy (the radial component of the Poynting vector) per steradian is inversely proportional to the solar wind velocity. It is a decreasing function of the heliocentric distance. When the magnetic field effect is included in the one-fluid model of the solar wind, the transformation of magnetic field energy into kinetic energy during the expansion process increases the solar wind velocity at 1 AU by 17 percent. Author

N73-10781* Tel-Aviv Univ. (Israel). Dept. of Physics and Astronomy.

SOME PHYSICAL IMPLICATIONS OF RECENT SOLAR WIND MEASUREMENTS

Sami Cuperman and A. Harten *In* NASA. Ames Res. Center Solar Wind 1972 p 244-247 refs (For availability see N73-10760 01-29)
CSCL 03B

The physical implications of the existence at about 1 AU of a quiet solar wind particle flux about 90 percent larger than that suggested in the past is investigated within the framework of the two-fluid solar wind model equations. During the spherically symmetric radial expansion of the quiet solar wind, the particle flux is conserved quantity. It is found that a pure collisional two-fluid model provides good particle density and streaming velocity at 1 AU, but predicts too large an electron temperature and too small a proton temperature. When noncollisional contributions to the transport coefficients are incorporated in the model equations, a complete satisfactory agreement with the available observations is obtained. Upper limits to the effective coupling between electrons and protons, as well as to the effective proton thermal conductivity, and both upper and lower limits to the effective electron thermal conductivity in the quiet solar wind, required to provide agreement with observations, are given. Author

N73-10782* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

MODEL FOR ENERGY TRANSFER IN THE SOLAR WIND: FORMULATION OF MODEL

R. E. Hartle and Aaron Barnes *In its* Solar Wind 1972 p 248-251 refs (For availability see N73-10760 01-29)
CSCL 03B

The two-fluid solar-wind model is extended by including the collisionless dissipation of hydromagnetic waves originating at the sun. A series of solar wind models is generated, parameterized by the total energy flux of hydromagnetic waves at the base of the model. The resulting properties of propagation and dissipating of hydromagnetic waves on this model are presented. Author

N73-10783* High Altitude Observatory, Boulder, Colo.

A GAS-DYNAMIC CALCULATION OF TYPE 2 SHOCK PROPAGATION THROUGH THE CORONA

Roger A. Kopp *In* NASA. Ames Res. Center Solar Wind 1972 p 252-257 refs (For availability see N73-10760 01-29)
CSCL 03B

An approximate analytic theory of acoustic shock propagation in nonuniform media is used to determine the motion of a flare-generated shock wave in the corona. The shock is followed from the time it strikes the chromosphere-corona transition region (density interface) out to 5 solar radii under the assumption that the corona in this region is approximately in hydrostatic equilibrium. The strength of the shock incident on the transition region from below determines the ejection velocity of eruptive prominence material, as well as the initial velocity of the coronal shock. The calculation is applied to one well-documented case of a related flare spray, moving type 4 isolated source, and type 2 burst. It is shown that a chromospheric shock of the appropriate strength to produce the observed prominence and type 4 velocities strengthens as it moves out in the corona by an amount sufficient to account for the observed high velocity of the type 2 burst. Author

N73-10784* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EVIDENCE FOR AN ANGULAR MOMENTUM FLUX IN THE SOLAR WIND

In its Solar Wind 1972 p 261-275 refs (For availability see N73-10760 01-29)
CSCL 03B

A round table discussion of problems of solar and stellar spindown and theory is presented. Observational evidence of the angular momentum flux of the solar wind is emphasized. J.A.M.

N73-10785* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EVIDENCE FOR CHANGES IN THE ANGULAR VELOCITY OF THE SURFACE REGIONS OF THE SUN AND STARS c30

In its Solar Wind 1972 p 276-286 refs (For availability see N73-10760 01-29)
CSCL 03A

A round table discussion of problems of solar and stellar spindown and theory is presented. Observational evidence of the angular momentum of the solar wind is included, emphasizing changes in the angular velocity of the surface regions of the sun and stars. J.A.M.

N73-10786* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EVIDENCE FOR THE DISTRIBUTION OF ANGULAR VELOCITY INSIDE THE SUN AND STARS c30

In its Solar Wind 1972 p 287-306 refs (For availability see N73-10760 01-29)
CSCL 03A

A round table discussion of problems of solar and stellar spindown and theory is presented. Observational evidence of the angular momentum of the solar wind is included, emphasizing the distribution of angular velocity inside the sun and stars. J.A.M.

N73-10787* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MICROSTRUCTURE OF THE INTERPLANETARY MEDIUM c30

L. F. Burlaga *In its* Solar Wind 1972 309-332 refs (For availability see N73-10760 01-29)
CSCL 03B

High time resolution measurements of the interplanetary magnetic field and plasma reveal a complex microstructure which includes hydromagnetic wave and discontinuities. The identification of hydromagnetic waves and discontinuities, their statistical properties, their relation to large-scale structure, and their relative contribution to power spectra are discussed. Author

N73-10788* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MICROSCALE FLUCTUATIONS IN THE SOLAR WIND
Aaron Barnes *In its* Solar Wind 1972 p 333-352 refs (For availability see N73-10760 01-29)
CSCL 03B

Theoretical constraints on the interpretation of fluctuations (either propagating or stationary) in the interplanetary medium are reviewed, with emphasis on the important differences between the properties of hydromagnetic waves (and stationary structures) in collisionless and in collision-dominated plasmas, and on the possible roles of Landau damping and nonlinear effects in determining the interplanetary fluctuation spectrum. Hypotheses about the origins of the fluctuations and their influence on the large-scale properties of the solar wind are reviewed. Author

N73-10789* TRW Systems Group, Redondo Beach, Calif. Space Sciences Lab.
ELECTRON PLASMA OSCILLATIONS IN THE NEAR-EARTH SOLAR WIND: PRELIMINARY OBSERVATIONS AND INTERPRETATIONS
Robert W. Fredricks, Frederick L. Scarf, and I. M. Green *In* NASA. Ames Res. Center Solar Wind 1972 p 353-359 refs (For availability see N73-10760 01-29)
(Contract NAS5-9278)
CSCL 03B

Preliminary results and conclusions of a study of electric field oscillations in the upstream solar wind are reported. The OGO-5 orbits are on the dusk (three) and on the dawn (one) sides of the earth-sun line. It is concluded that there are electron streams produced at or near the bow shock. These streams penetrate the incoming solar wind plasma, and generate quasi-electromagnetic waves. The streams (as inferred from the wave levels) occur without regard to dawn-dusk location, as opposed to the low-frequency MHD upstream disturbances driven by backstreaming protons, which show a definitely strong preference for the dawn-noon sector. The presence of the suprathermal electron streams and associated wave turbulence indicates that some near-earth electron distributions are probably not representative of true solar wind distributions far away from the earth. Author

N73-10790* European Space Research Inst., Frascati (Italy).
MAGNETIC FIELD MERGING IN THE SOLAR WIND
Karl Schindler *In* NASA. Ames Res. Center Solar Wind 1972 p 360-364 refs (For availability see N73-10760 01-29)
CSCL 03B

Magnetic field merging in the solar wind is discussed in terms of steady-state merging, which involves a steady flow field, and of spontaneous merging, which involves an instability such as the tearing instability. Spontaneous merging is found to be more effective than steady-state merging. Author

N73-10791* California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
COMMENTS ON THE MEASUREMENT OF POWER SPECTRA OF THE INTERPLANETARY MAGNETIC FIELD
Christopher T. Russell *In* NASA. Ames Res. Center Solar Wind 1972 p 365-374 refs (For availability see N73-10760 01-29)
(Contract NAS5-9098)
CSCL 03B

Examination of possible noise sources in the measurement of the power spectrum of fluctuations in the interplanetary magnetic field shows that most measurements by fluxgate magnetometers are limited by digitization noise whereas the search coil magnetometer is limited by instrument noise. The folding of power about the Nyquist frequency or aliasing can be a serious problem at times for many magnetometers, but it is not serious during typical solar wind conditions except near the Nyquist frequency. Waves in the solar wind associated with the presence of the earth's bow shock can contaminate the interplanetary spectrum in the vicinity of the earth. However, at times the spectrum in this region is the same as far from the earth. Doppler shifting caused by the convection of waves by the solar wind makes the interpretation of interplanetary spectra difficult. Author

N73-10792* California Univ., Los Angeles. Dept. of Planetary and Space Science.
POWER SPECTRA OF THE INTERPLANETARY MAGNETIC FIELD NEAR THE EARTH c30

D. D. Childers and Christopher T. Russell *In* NASA. Ames Res. Center Solar Wind 1972 p 375-381 refs (For availability see N73-10760 01-29)
CSCL 03B

Power spectra of the interplanetary magnetic field measured by near-earth satellites upstream from the earth's bow shock are free from terrestrial contamination provided the field at the satellite does not intersect the bow shock. Considerable spectral enhancement for the range of frequencies 0.01 to 1.00 Hz, due to turbulence caused by the shock, may occur if the field observed at the satellite intersects the shock. This turbulence occurs frequently in both the morning and afternoon quadrants. In the frequency band from 0.07 to 1 Hz, this noise decreases in amplitude with radial distance from the shock with an attenuation length of 4 R sub E. Author

N73-10793* Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
CORONAL ALFVEN WAVES AND THE SOLAR WIND
John W. Belcher *In* NASA. Ames Res. Center Solar Wind 1972 p 382-389 refs (For availability see N73-10760 01-29)
CSCL 03B

The observed properties of coronal Alfven waves in the solar wind at 1 AU are briefly reviewed, with some theoretical discussion of their probable effects on the dynamics of the expanding solar corona. It is concluded that coronal Alfven waves can have a major influence on both the small- and large-scale properties of the wind at 1 AU. Author

N73-10794* Los Alamos Scientific Lab., N.Mex.
INTERPLANETARY SHOCK WAVES AND THE STRUCTURE OF SOLAR WIND DISTURBANCES
A. J. Hundhausen *In* NASA. Ames Res. Center Solar Wind 1972 p 393-420 refs Sponsored in part by AEC (For availability see N73-10760 01-29)
CSCL 03B

Observations and theoretical models of interplanetary shock waves are reviewed, with emphasis on the large-scale characteristics of the associated solar wind disturbances and on the relationship of these disturbances to solar activity. The sum of observational knowledge indicates that shock waves propagate through the solar wind along a broad, roughly spherical front, ahead of plasma and magnetic field ejected from solar flares. Typically, the shock front reaches 1 AU about two days after its flare origin, and is of intermediate strength. Not all large flares produce observable interplanetary shock waves; the best indicator of shock production appears to be the generation of both type 2 and type 4 radio bursts by a flare. Theoretical models of shock propagation in the solar wind can account for the typically observed shock strength, transit time, and shape. Author

N73-10795* TRW Systems Group, Redondo Beach, Calif. Space Sciences Lab.
COMPARISON OF DEEP SPACE AND NEAR-EARTH OBSERVATIONS OF PLASMA TURBULENCE AT SOLAR WIND DISCONTINUITIES
Frederick L. Scarf, Robert W. Fredricks, and I. M. Green *In* NASA. Ames Res. Center Solar Wind 1972 p 421-429 refs (For availability see N73-10760 01-29)
(Contracts NASw-2113; NAS5-9278; NAS2-4573)
CSCL 03B

Simultaneous observations of plasma waves from the electric field instruments on Pioneer 9 and OGO 5 are used to illustrate the difference between near-earth and deep space conditions. It is shown that the experimental study of true interplanetary wave-particle interactions is difficult to carry out from an earth orbiter because the earth provides significant fluxes of nonthermal particles that generate intense plasma turbulence in the upstream region. Author

N73-10796* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COROTATING SHOCK STRUCTURES
Keith W. Ogilvie *In its* Solar Wind 1972 p 430-434 refs (For availability see N73-10760 01-29)
CSCL 03B

Consideration of observed interplanetary shocks leads to the conclusion that a corotating forward shock has not been unambiguously identified at 1 AU. A reverse shock identified in September 1967 is a likely candidate for a corotating structure. Author

N73-10797* Rome Univ. (Italy).
SHOCK PAIR OBSERVATION
J. K. Chao, Vitorio Formisano, and Peter C. Hedgecock (Imperial Coll. of Sci. and Technol.) *In* NASA. Ames Res. Center Solar Wind 1972 p 435-442 (For availability see N73-10760 01-29)
CSCL 03B

On day 84, 1969, the HEOS 1 satellite observed a shock pair connected with a plasma bulk velocity increase from 400 to approximately 750 km/sec. Both shocks were fast shocks. The forward shock had a Mach number of 1.7, the reverse shock had M(fast) = 1.4. The time interval between the two shocks was 7 hrs, 10 min. The time delay between HEOS 1 and Explorer 35 reverse shock observation (20 + or - 6 min) agrees with the computed time delay (11 + or - 4 min). Author

N73-10798* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A TWO-SPACECRAFT TEST OF A SINGLE SPACECRAFT METHOD OF ESTIMATING SHOCK NORMALS c30
Ronald P. Lepping *In its* Solar Wind 1972 p 444-452 refs (For availability see N73-10760 01-29)
CSCL 03B

By assuming the validity of a subset of the Rankine-Hugoniot conservation relations for interplanetary (IP) shocks in an isotropic medium it has been demonstrated, in principle, that improved shock normals can be calculated by using a least-squares technique on combined magnetic field and plasma data from a single spacecraft. The scheme uses those six conservation relations not involving pressure and temperature. This paper deals with a test of the scheme by examining in detail a shock across which the magnetic field changed direction by a small amount (approximately 10 deg). On January 26, 1968 at about 1430 UT this shock was observed by the plasma and magnetic field instruments in Explorers 33 and 35. The spacecraft were 76.6 and 56.9 R sub E sunward of the earth, respectively (and 43.5 R sub E from each other), and therefore well outside the earth's bow shock region, a necessary condition for a valid test. Author

N73-10799* National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
INTERPLANETARY DOUBLE-SHOCK ENSEMBLES WITH ANOMALOUS ELECTRICAL CONDUCTIVITY c30
Murray Dryer *In* NASA. Ames Res. Center Solar Wind 1972 p 453-471 refs (For availability see N73-10760 01-29)
CSCL 03B

Similarity theory is applied to the case of constant velocity, piston-driven, shock waves. This family of solutions, incorporating the interplanetary magnetic field for the case of infinite electric conductivity, represents one class of experimentally observed, flare-generated shock waves. This paper discusses the theoretical extension to flows with finite conductivity (presumably caused by unspecified modes of wave-particle interactions). Solutions, including reverse shocks, are found for a wide range of magnetic Reynolds numbers from one to infinity. Consideration of a zero and nonzero ambient flowing solar wind (together with removal of magnetic considerations) enables the recovery of earlier similarity solutions as well as numerical simulations. A limited comparison with observations suggests that flare energetics can be reasonably estimated once the shock velocity, ambient solar wind velocity and density, and ambient azimuthal Alfven Mach number are known. Author

N73-10800* Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.
THE NATURE OF STREAM-STREAM INTERACTION IN THE LARGE-SCALE STRUCTURE OF THE SOLAR WIND
T. S. Lee *In* NASA. Ames Res. Center Solar Wind 1972 p 472-474 refs (For availability see N73-10760 01-29)
CSCL 03B

The stream-stream interaction between a slow solar wind and its leading faster solar wind is considered. A hydrodynamic model comprising double-layered rarefactions and recompressions is proposed toward understanding the observed large-scale structure near the trailing portion of a high-speed stream. Author

N73-10801* Mullard Radio Astronomy Observatory, Cambridge (England). Cavendish Lab.
OBSERVATIONS OF THE SOLAR PLASMA USING RADIO SCATTERING AND SCINTILLATION METHODS
A. Hewish *In* NASA. Ames Res. Center Solar Wind 1972 p 477-493 refs (For availability see N73-10760 01-29)
CSCL 03B

Observations of the solar plasma using the interplanetary scintillation technique have been made at radial distances of 0.03 to 1.2 AU. The solar wind is found to be independent of ecliptic latitude and radial distance, except close to the sun where acceleration is observed. Plasma density irregularities on a scale near the proton gyro radius, which modulate the mean density by about 1 percent, are present throughout the observed range of radial distance. Author

N73-10802* California Inst. of Tech., Pasadena. Dept. of Physics.
WAVELENGTH DEPENDENCE OF THE INTERPLANETARY SCINTILLATION INDEX
Joseph V. Hollweg and J. R. Jokipii *In* NASA. Ames Res. Center Solar Wind 1972 p 494-505 refs (For availability see N73-10760 01-29)
CSCL 03B

Published observations of the interplanetary scintillation index m sub z are shown to vary with wavelength in a manner consistent with a smooth, power law spectrum of plasma fluctuations. This is in contrast to recent work arguing that the data require a spectrum with two separate regimes. It is concluded that published observations of m sub z are consistent with either type of density spectrum. Author

N73-10803* Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
SPECTRA AND CROSS SPECTRA OF SOLAR WIND PARAMETERS FROM MARINER 5
B. Goldstein and George L. Siscoe *In* NASA. Ames Res. Center Solar Wind 1972 p 506-516 refs Prepared in cooperation with Calif. Univ., Los Angeles (For availability see N73-10760 01-29)
(Grants NGL-22-009-372; NGR-05-007-304; NSF GA-13554)
CSCL 03B

The spectra of the radial (V sub R) and nonradial (V sub T, V sub N) velocity components of the solar wind, the proton density (rho) and the proton thermal speed (W), show increasing power with increasing period up to a period of about 1 day. The powers tend to level off above 1 day except for that of V sub R which continues to increase up to a period of 10 days. At all periods, the power is V sub R is greater than that in V sub T V sub N, and W, and the difference becomes very large at the longest periods because of the increasing power in V sub R. The powers in V sub T V sub N, and W are similar at all periods. The cross spectra reveal a sharp change in behavior at periods above and below approximately 1 day, suggesting that two distant types of physical processes must dominate above and below this dividing period. In general, the coherences at the long periods are larger than at the short periods suggesting

that the physical situation in the long period regime may be simpler than in the short period regime where multiple processes appear to be required to account for the low coherences.

Author

N73-10804* National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
EVIDENCE FOR A CONTINUOUS, POWER LAW, ELECTRON DENSITY IRREGULARITY SPECTRUM **c30**
Willard M. Cronyn *In* NASA. Ames Res. Center Solar Wind 1972 p 517-520 refs (For availability see N73-10760 01-29)
CSCL 03B

The spectral form of the irregularities in electron density that cause interplanetary scintillation (IPS) of small angular diameter radio sources is discussed. The intensity scintillation technique always yields an irregularity scale size, which is of the order of the first Fresnel zone for the wavelength at which the observations are taken. This includes not only the radio wavelength measurements of the structure of the interplanetary medium, but also radio wavelength measurements of the irregularity structure of the ionosphere and interstellar medium, and optical wavelength measurements of the irregularity structure of the atmosphere. Author

N73-10805* Stanford Univ., Calif. Center for Radar Astronomy.
COROTATION OF AN INTERMITTENT SOLAR WIND SOURCE
Thomas A. Croft *In* NASA. Ames Res. Center Solar Wind 1972 p 521-531 refs (For availability see N73-10760 01-29)
(Contract NAS2-4672; Grant NGR-05-020-407)
CSCL 03B

The measured electron content of the solar wind in mid-1970 exhibited a region of relatively high electron density that reappeared at intervals of about 27.8 days. It is shown that the repeating event cannot be reconciled with the concept of a long-enduring steady flow, even though the recurrence period is close to the rotation period of the sun. This evidence of transients is inferred from the short duration of each appearance of the interval of higher density; each should last for roughly one corotation interval if it is caused by a steady stream. The radio path was approximately 0.8 AU long, and the corotation interval exceeded 3 days. Other aspects of the content data patterns support the view that such transient events are common in the solar wind. The mid-1970 repeating event is an unusually good example of the intermittent character of flow regions in the solar wind that fluctuate on a time scale of days but endure as identifiable regions for many months. A sputtering corotating source of thin solar plasma streams could explain this series of events; it could also be explained in terms of a stream that is steady in density and speed but undulating north-south so that it passes into and out of the 0.8 AU radio path in a matter of a day or less. Author

N73-10806* Los Alamos Scientific Lab., N.Mex.
SPACECRAFT OBSERVATIONS OF THE SOLAR WIND COMPOSITION
S. J. Bame *In* NASA. Ames Res. Center Solar Wind 1972 p 535-558 refs Sponsored in part by AEC (For availability see N73-10760 01-29)
CSCL 03B

Solar wind composition studies by means of plasma analyzers carried on various spacecraft are reviewed. The average ratio of helium to hydrogen over the solar cycle is close to 0.045; values as low as 0.0025 and as high as 0.25 have been observed. High values have been observed following solar flares and interplanetary shock waves when the flare gas driving the shock arrives at the spacecraft. Ions of He-3(+2), O-16(+6), and O-16(+7) have been observed with Vela 3 electrostatic analyzers. Further measurements with Vela 5 analyzers have shown the presence of N-14(+6), Si-28(+7) to Si-28(+9) and Fe-56(+7) to Fe-56(+12) ions. The relative abundance of oxygen, silicon, and iron in the solar wind of July 6, 1969, was 1.00, 0.21, and 0.17, which is very similar to reported values for the corona. The ratio of helium to oxygen is variable; the average value of He/O is close to 100, but values between 30 and 400 have been observed. Author

N73-10807* Bern Univ. (Switzerland).
ELEMENTAL AND ISOTOPIC ABUNDANCES IN THE SOLAR WIND
Johannes Geiss *In* NASA. Ames Res. Center Solar Wind 1972 p 559-581 refs (For availability see N73-10760 01-29)
CSCL 03B

The use of collecting foils and lunar material to assay the isotopic composition of the solar wind is reviewed. Arguments are given to show that lunar surface correlated gases are likely to be most useful in studying the history of the solar wind, though the isotopic abundances are thought to give a good approximation to the solar wind composition. The results of the analysis of Surveyor material are also given. The conditions leading to a significant component of the interstellar gas entering the inner solar system are reviewed and suggestions made for experimental searches for this fraction. A critical discussion is given of the different ways in which the basic solar composition could be modified by fractionation taking place between the sun's surface and points of observation such as on the Moon or in interplanetary space. An extended review is made of the relation of isotopic and elemental composition of the interplanetary gas to the dynamic behavior of the solar corona, especially processes leading to fractionation. Lastly, connection is made between the subject of composition, nucleosynthesis and the convective zone of the sun, and processes leading to modification of initial accretion of certain gases on the Earth and Moon. Author

N73-10808* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SOLAR WIND HELIUM ENHANCEMENTS FOLLOWING MAJOR SOLAR FLARES
Joan Hirshberg *In its* Solar Wind 1972 p 582-587 refs (For availability see N73-10760 01-29)
CSCL 03B

The observations of solar wind helium enhancements following major solar flares are reviewed, and the hypothesis that helium enhancements often mark flare piston plasma is confirmed. Helium enhancements were observed during each of the three periods (March 1966, July 1966, August/September 1966) of major solar activity that occurred from October 1965 to October 1966. No enhancements were seen during the long quiet periods that occurred that year. At 1 AU, the helium-enhanced plasma pistons had slowed so that the velocity was 80 percent of the mean transit velocity, in general agreement with theoretical models of the propagation of flare disturbances. A qualitative model, in which the piston plasma is accelerated from the flare site deep in the corona, is discussed briefly. If the model is valid in general outline, the piston plasmas provide samples of material from the lower levels of the corona. Author

N73-10809* Consiglio Nazionale delle Ricerche, Rome (Italy). Lab. per lo Studio del Plasma nello Spazio.
HEOS 1 HELIUM OBSERVATIONS IN THE SOLAR WIND
D. Bollea, Vitorio Formisano, Peter C. Hedgecock (Imp. Coll. of Sci. and Techol., London, Engl.), Giovanni Moreno (CNR, Bologna, Italy), and F. Palmiotto *In* NASA. Ames Res. Center Solar Wind 1972 p 588-597 refs (For availability see N73-10760 01-29)
CSCL 03B

Results of alpha-particle observations performed by the European satellite HEOS 1, in the period from December 9, 1968, to April 13, 1969, and from September 6, 1969, to April 15, 1970, are presented. The average bulk velocities of protons V sub p and alpha-particles V sub alpha appear to be equal; however, due to an instrumental bias, the possibility of V sub alpha being lower than V sub p cannot be ruled out. Comparison with observations of Vela 3 and Explorer 34 satellites gives evidence of a dependence of helium abundance on the solar cycle. The problem of the stability of differences between the bulk velocities of protons and alpha-particles is investigated. The behavior of alpha-particles through interplanetary shock waves is illustrated in connection with magnetic field measurements. Author

N73-10810* Stanford Univ., Calif. Center for Radar Astronomy.
RADIO DETECTION OF SOLAR WIND DISCONTINUITIES
Jeremy A. Landt *In* NASA. Ames Res. Center Solar Wind 1972 p 598-606 refs (For availability see N73-10760 01-29)

(Contract NAS2-4672; Grant NGR-05-020-407)
CSCL 03B

Geomagnetic field sudden increases or storm sudden commencements are compared with measurements of electron content of the solar wind. The latter data are obtained by a radio propagation experiment, which measures the electron content along a radio path between transmitters on the ground and several spacecraft in solar orbit. Measurements were examined during time periods that included 40 of the geomagnetic disturbances (gmd) reported between January 1, 1966, and June 30, 1969. These studies indicate that some widely reported solar wind discontinuities have been detected by the radio propagation experiment. Eleven of the 40 gmd were classified as storm sudden commencements (ssc), which usually result when a shock in the solar wind strikes the magnetosphere. The relative timings of these 11 events are consistent with conclusions drawn from comparisons of experiment geometry to prevailing shock models. Compared to the nature of these 11 events, the characteristics of the solar-wind disturbances corresponding to the remaining 29 gmd were generally found to have been less favorable for detection by the radio propagation experiment, but sharp changes in the content were clearly evident at the time of several minor gmd. Author

N73-10811* California Univ., La Jolla. Dept. of Physics and Applied Physics and Information Science.
THE INTERACTION OF THE SOLAR WIND WITH THE INTERSTELLAR MEDIUM
W. Ian Axford *In* NASA. Ames Res. Center Solar Wind 1972 p 609-660 refs (For availability see N73-10760 01-29)
(Grant NGR-05-009-081)
CSCL 03B

The expected characteristics of the solar wind, extrapolated from the vicinity of the earth are described. Several models are examined for the interaction of the solar wind with the interstellar plasma and magnetic field. Various aspects of the penetration of neutral interstellar gas into the solar wind are considered. The dynamic effects of the neutral gas on the solar wind are described. Problems associated with the interaction of cosmic rays with the solar wind are discussed. Author

N73-10812* Centre National de la Recherche Scientifique, Verrieres-le-Buisson (France). Service d'Aeronomie.
OBSERVATION OF LYMAN-alpha EMISSION IN INTERPLANETARY SPACE
J. L. Bertaux and J. E. Blamont *In* NASA. Ames Res. Center Solar Wind 1972 p 661-667 refs (For availability see N73-10760 01-29)
CSCL 03B

The extraterrestrial Lyman-alpha emission was mapped by the OGO 5 satellite, when it was outside the geocorona. Three maps, obtained at different periods of the year, are presented and analyzed. The results suggest that at least half of the emission takes place in the solar system, and give strong support to the theory that in its motion toward the apex, the sun crosses neutral atomic hydrogen of interstellar origin, giving rise to an apparent interstellar wind. Author

N73-10813* Colorado Univ., Boulder. Dept. of Astro-Geophysics.
PROPERTIES OF NEARBY INTERSTELLAR HYDROGEN DEDUCED FROM LYMAN-alpha SKY BACKGROUND MEASUREMENTS c30
Gary E. Thomas *In* NASA. Ames Res. Center Solar Wind 1972 p 668-683 refs (For availability see N73-10760 01-29)
(Contract NAS5-9327; Grant NGR-06-003-052)
CSCL 03B

For a sufficiently rapid relative motion of the solar system and the nearby interstellar gas, neutral atoms may be expected to penetrate the heliosphere before becoming ionized. Recent satellite measurements of the Lyman alpha emission above the geocorona indicate such an interstellar wind of neutral hydrogen emerging from the direction of Sagittarius and reaching to within a few astronomical units of the sun. A detailed model of the scattering of solar Lyman alpha from the spatial distribution of neutral hydrogen in interplanetary space is presented. This asymmetric distribution is established by solar wind and solar ultraviolet ionization processes along the trajectories of the incoming hydrogen atoms. The values of the interstellar density, the relative velocity, and the gas temperature are adjusted to agree with the Lyman alpha measurements. The results may be interpreted in terms of two models, the cold model and the hot model of the interstellar gas, depending on whether galactic Lyman alpha emission is present at its maximum allowable value or negligibly small. Author

N73-10814* Los Alamos Scientific Lab., N.Mex.
INTERSTELLAR HELIUM IN INTERPLANETARY SPACE c30
William C. Feldman, J. J. Lange (Wright-Patterson AFB, Ohio), and Frank Scherb (Wisconsin Univ., Madison) *In* NASA. Ames Res. Center Solar Wind 1972 p 684-697 refs Sponsored in part by AEC (For availability see N73-10760 01-29)
(Grants NGL-50-002-044; NGR-50-002-162)
CSCL 03B

The velocity distribution function of He(+) in the solar wind at 1 AU is calculated with the assumption that the source is photoionization of a cold (T = 100 K), neutral interstellar wind. If the spiral magnetic field is noise free, the velocity distribution is diffuse and would not produce a peak at 4(E over Q) sub H in an E over Q particle spectrum. If the velocity of the interstellar wind with respect to the sun lies in the ecliptic, a large variation of the He(+) number density with respect to ecliptic longitude is expected. Author

N73-10815* California Univ., Los Angeles. Dept. of Planetary and Space Science.
EFFECTS OF INTERSTELLAR PARTICLES UPON THE INTERPLANETARY MAGNETIC FIELD c30
Paul J. Coleman, Jr. and Edwin M. Winter *In* NASA. Ames Res. Center Solar Wind 1972 p 698-701 refs Sponsored in part by NSF (For availability see N73-10760 01-29)
(Grant NGL-05-007-004)
CSCL 03B

The flow of interstellar neutral particles into the interplanetary medium and their subsequent ionization in the presence of the electromagnetic field of the solar wind can cause a loss of field angular momentum by the solar wind. One effect of this loss of field angular momentum is a significant unwinding of the spiral field. This effect is evaluated using simple models for neutral density and ion production. For a free-stream interstellar medium with a neutral hydrogen density of 1 per cubic centimeter and a velocity relative to the sun of 10 to 20 km per second, the spiral angle at the orbit of Jupiter will be less than its nominal value of 45 deg at the orbit of the earth. Author

N73-10816* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NEW EVIDENCE FOR SOLAR CYCLE VARIATIONS AT GREAT DISTANCES
D. Venkatesan (Calgary Univ., Alberta) and V. K. Balasubrahmanyan *In its* Solar Wind 1972 p 704-708 refs (For availability see N73-10760 01-29)
CSCL 03B

Recent studies of solar planetary relationships are directed toward exploring how far out from the sun one could observe solar cycle variations. A positive solar Jovian relationship is suggested from a Chree superposed epoch study of the intensity of the great red spot of Jupiter over a period of about six solar cycles. The characteristic double maxima observed in the solar cycle variation is common to other observations of solar events in the photosphere, chromosphere, and corona; radio and corpuscular emissions from the sun; cosmic ray intensity and geomagnetic activity. The same method of analysis adopted for the study of luminosity changes of the planets Jupiter, Saturn, Uranus, and Neptune indicates that the fluctuations of luminosity follow the single maximum solar cycle represented by sunspot numbers. In conjunction with changes of upper atmospheric density and temperature, it is suggested that the extreme ultraviolet (EUV) emission from the sun may be connected with luminosity changes. A method of distinguishing between phenomena related to solar wind and those related to solar EUV is presented. Author

N73-10817# Observatoire de Paris-Meudon (France). Astrophysics Section.
SYNOPTIC CHARTS OF THE SOLAR CHROMOSPHERE AND

CATALOGS OF FILAMENT AND ACTIVITY CENTERS, VOLUME 5, PART 3 Annual Report, 1970 - 1971 [CARTES SYNOPTIQUES DE LA CHROMOSPHERE SOLAIRE ET CATALOGUES DES FILAMENTS ET DES CENTRES D'ACTIVITE, VOLUME 5, FASCICULE 3]
31 Dec. 1971 87 p In FRENCH Sponsored in part by UNESCO
Avail: NTIS HC $6.50

Twenty-seven synoptic charts are presented which correspond to the beginning of the waning period of the solar activity cycle. The charts and associated catalogues describe the activity centers and chromospheric filaments observed from 24 to 31 December, 1971. Transl. by K.P.D.

N73-10818*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POSITION ANNIHILATION RADIATION FROM NEUTRON STARS
Reuven Ramaty, Gerhard Borner, and Jeffrey M. Cohen (Pennsylvania Univ.) Sep. 1972 16 p refs Submitted for publication
(NASA-TM-X-66062; X-660-72-367) Avail: NTIS HC $3.00 CSCL 03B

Matter accreted on the surfaces of neutron stars consists of energetic particles of a few tens to a couple hundred MeV/nucleon, depending on the neutron star mass. In addition to heat, such particles produce nuclear reactions with the surface material. It is proposed that the recently observed 473 + or - 30 keV spectral feature from the galactic center is gravitationally red-shifted positron annihilation radiation produced at the surfaces of old neutron stars. The principal observational tests of the model would be the detection of nuclear gamma ray lines from the galactic center and red-shifted positron annihilation radiation from the galactic disk. Author

N73-10819*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INVESTIGATION OF RESONANCE INTEGRALS OCCURRING IN COSMIC RAY DIFFUSION THEORY
Frank C. Jones, Thomas J. Birmingham, and Thomas B. Kaiser (Md. Univ., College Park) Oct. 1972 10 p refs Presented at the Intern. Conf. on Solar Terrest. Relations, Calgary, Alberta, Aug. 1972
(Grant NGL-21-002-033)
(NASA-TM-X-66077; X-641-72-375) Avail: NTIS HC $3.00 CSCL 03B

The method for calculating the pitch angle diffusion coefficient is investigated for cosmic rays in a static random magnetic field, using the resonance integral method. The pitch angle diffusion coefficient may be derived from the Vlasov equation via ensemble averaging. Author

N73-10820# California Univ., Berkeley. Space Sciences Lab.
THE 20-36 GHz VENUS MICROWAVE EMISSION Final Report
Michael Allen Janssen, Samuel Silver, and William J. Welch Apr. 1972 138 p refs
(Contract N00014-69-A-0200-1047)
(AD-743982; SSL-Ser-13-Issue-51) Avail: NTIS CSCL 03/2

The results of both total flux measurements and measurements at high spatial resolution of the microwave emission from Venus in the neighborhood of one centimeter wavelength are presented and examined. A newly constructed millimeter wave interferometer was used to observe Venus following the 1970 conjunction, giving information on the brightness temperature distribution across the disk with an effective resolution of about one-third of the disk diameter. Calculations of the total flux and visibility function of Venus are made using an atmospheric model based on the measurements made by the spacecraft Mariner V and Veneras 4 through 7. Author (GRA)

N73-10821# California Inst. of Tech., Pasadena. Dept. of Physics.
COSMIC RAY RESEARCH Final Report, 1 Dec. 1963 - 1 Jul. 1972
E. W. Cowan 20 Jul. 1972 4 p refs
(Contract N00014-67-A-0094-0016; NR Proj. 323-005)
(AD-745331; TR-40) Avail: NTIS CSCL 04/1

The research conducted under this contract has been divided into two main efforts; measurements of cosmic-ray intensity in and above the atmosphere as a function of altitude, latitude and time through several solar cycles, and measurements of the interactions of high-energy cosmic rays at sea level and improvements in the instruments used in such measurements. The results are summarized in the publications listed. GRA

N73-10822# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
CONTINUOUS MONITORING OF SOLAR X-RAYS. PART 1: DEVELOPMENT OF A PROGRAM FOR AWS USE WITH THE VELA SATELLITE DATA Environmental Research Papers
James E. Manson and Patricia M. Bench 1 Mar. 1972 40 p refs
(AF Proj. 8666)
(AD-743921; AFCRL-ERP-389; AFCRL-72-0140) Avail: NTIS CSCL 04/1

A computer program for the rapid reduction of the Vela satellite X-ray data has been developed for use at the Air Force Global Weather Central computer facility of the Air Weather Service. The physical reasoning and mathematical analysis underlying this program are presented. Sufficient detail is included to allow an understanding of the source program listing. As originally set up, this program delivers a two-temperature bremsstrahlung equation approximation to the solar X-ray flux for each 32 seconds of data. From this approximation, sets of values of 0.5 - 3A flux and 1 - 8 A flux are stored, and periodically searched to detect possible X-ray flares. For each flare which is detected, parameters such as start time, maximum time, and total energy are stored for recall on demand. Author (GRA)

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N73-10823 National Lending Library for Science and Technology, Boston Spa (England).
SPACE EXPLORATION ON A GRAND SCALE: SOVIET-AMERICAN RADIOASTRONOMIC RESEARCH
I. Shklovsky and L. Matveyenko 18 May 1972 5 p Transl. into ENGLISH from Izv. (Moscow), 18 May 1972
(NLL-M-22684-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Areas and techniques of potential cooperative research in radio astronomy are briefly reviewed. The interferometric method of using radio telescopes to improve resolution is described, and specific U.S.-U.S.S.R. experiments using this method are mentioned. Quasars and compact nebulae are considered the likely areas of research, and current knowledge about them is outlined. A project having one interferometer element in outer space is being developed by astronomers from the two countries. N.E.N.

N73-10824*# Lockheed Missiles and Space Co., Palo Alto, Calif.
THE PECULIAR O6f STAR HD 148937 AND THE SYMMETRICALLY SURROUNDING NEBULAE
Hugh M. Johnson [1972] 13 p refs
(Contracts NASW-1977; N00014-69-C-0147)
(NASA-CR-128404) Avail: NTIS CSCL 03A

The ultraviolet continuum of the star is observed and, after standard reddening corrections are applied, it is found to be hotter than a model O5 V star. The Of star and its two companions are photometered around wavelength 4640, 4686, and 4861 A. The results confirm Westerlund's (1960) absolute visual magnitude of about -6 for the Of star and confirm his rejection of NGC 6164-5 as a planetary nebula. Peculiarities of the system of nebular shells around HD 148937, of which NGC 6164-5 are the innermost, are discussed with reference to radiofrequency data. A standard extrapolation from the optical flux density of NGC 6164-5 predicts a detectable radio source but it does not appear in the relevant surveys. Author

N73-10825*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
ISAGEX (INTERNATIONAL SATELLITE GEODESY EXPERIMENT) EXPERIENCE. 1: DATA ACQUISITION
E. M. Gaposchkin, ed. May 1972 150 p refs
(Grant NGR-09-015-001)
(NASA-CR-128396) Avail: NTIS HC $9.50 CSCL 22C

The contributions and methods of the Smithsonian Astrophysical Observatory to the International Satellite Geodesy program are described. The report provides data users with necessary supporting information. Author

N73-10826# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
ASTRONOMICAL-GEODETIC OBSERVATIONS AT THE STATIONS ONSTMETTINGEN AND EMMINGEN (1964), BOCHUM AND VELBERT (1965) [ASTRONOMISCH-GEODATISCHE BEOBACHTUNGEN AUF DEN STATIONEN ONSTETTINGEN UND EMMINGEN (1964), BOCHUM UND VELBERT (1965)]
Karl-Wilhelm Schrick and Hellmut Walter 1971 29 p refs In GERMAN; ENGLISH summary
(Mitt-99; Rept-145) Avail: NTIS HC $3.50

Longitude, latitude, and azimuth were determined by means of a transit instrument at the Láplace stations of Onstmettingen, Emmingen, Bochum, and Velbert. Onstmettingen (1964) and Niederreifenberg (1965) were the reference stations for time determinations. The objects of the observations were to find the time using the instants of meridian transits of stars, to find the latitude using the differences of zenith angles in the meridian according to the method of Horrebow-Talcott, and to find the azimuth using the instants of star transits in the azimuth of the remote station. The motion of the pole was also considered. Author

N73-10827# Tokyo Astronomical Observatory (Japan).
NORTHERN PZT STARS OBSERVATION PROGRAM AND THE STATUS OF PZT CATALOGS IN CURRENT USE
Haruo Yasuda and Ichie Kamijo 1971 96 p refs
Avail: NTIS HC $7.00

The outline of the Northern PZT Stars Observation program is explained. The final accuracy observation is estimated from the experiences in AGK3R observations. Author

N73-10828# Research Inst. of National Defence, Stockholm (Sweden).
HAGFORS OBSERVATORY 1971 Annual Report
Ola Dahlman, Hans Israelson, Gunnel Hoernstroem, Bryant Lindh, Birgitta Moeller, Ingvar Nedgard, Leif Nordgren, Ragnar Slunga, and Boerje Soederstroem Sep. 1972 45 p refs
(FOA-4-A-4503-TR78) Avail: NTIS HC $4.25

The annual report from the Hagfors Observatory summarizes the work in 1971. Seismic signals have been recorded from 28 announced or presumed nuclear explosions and event locations have routinely been carried out. An algorithm for the location of local events with an accuracy of about 5 km has been developed. Beamforming of long- and shortperiod signals has been used as a way of increasing the long- and shortperiod detection capability. Shortperiod discriminants were used in a classification experiment where 87% of the explosions were correctly classified and 4% of the earthquakes were misclassified. A joint Canadian-Swedish shortperiod multistation discrimination study of Eurasian events has started. The confidence limits of identification curves were studied by computer simulation. Author

N73-10829# Royal Greenwich Observatory, Herstmonceux (England).
ROYAL OBSERVATORY ANNALS NO. 6: PHOTOHELIOGRAPHIC RESULTS 1962, 1963 AND 1964
1971 138 p refs Prepared in cooperation with Roy. Obs., Cape Town and Kodaikanal Obs., India
Avail: NTIS HC $9.00; Roy. Greenwich Obs., Herstmonceux: £2.20

Tables of positions and areas of sunspots, total areas of sunspots and faculae, and general catalogs of sunspots are presented for each year. The data were obtained at the Herstmonceux, Cape of Good Hope, and Kodaikanal observatories. N.E.N.

N73-10830*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
METEOR RESEARCH PROGRAM
A. F. II Cook, M. R. Flannery, H. Levy, II, R. E. McCrosky, Z. Sekanina, C.-Y. Shao, R. B. Southworth, and J. T. Williams Washington NASA Sep. 1972 171 p refs
(Contract NSR-09-015-033)
(NASA-CR-2109) Avail: NTIS HC $3.00 CSCL 03B

Statistics from a synoptic year sample of 20,000 radar meteor observations using an eight station radar network are presented. The synoptic year sample constitutes the largest, most accurate, and most complete body of radar meteor data in existence. Since it is such a large sample, results of individual meteors from the synoptic year sample such as orbital parameters, heights, ionization, etc., are listed on magnetic tape. Results of 29 simultaneous meteor observations are presented. Simultaneous meteor observations are observations of the same meteor using radar in conjunction with an image orthicon optical system. The simultaneous observations have been used to calibrate masses of radar meteors. Results indicate that masses of radar meteors have been underestimated by about an order of magnitude. For individual titles, see N73-10831 through N73-10844.

N73-10831* Smithsonian Astrophysical Observatory, Cambridge, Mass.
METEOR RESEARCH PROGRAM, EXECUTIVE SUMMARY Final Report
In its Meteor Res. Program Sep. 1972 p 1-17 refs (For availability see N73-10830 01-30)
CSCL 03B

A framework statement is provided of three problems together with brief comments on advances made during the course of this research. The problems discussed are: (1) generic relationships among comets, asteroids, meteorites, and meteoroids; (2) meteor physics; and (3) meteoroid hazard and the spatial distribution of meteoroid material. A summary of results is included. F.O.S.

N73-10832* Smithsonian Astrophysical Observatory, Cambridge, Mass.
DESCRIPTION OF EIGHT STATION RADAR NEAR HAVANA, ILLINOIS c07
Richard B. Southworth *In its* Meteor Res. Program Sep. 1972 p 19-27 refs (For availability see N73-10830 01-30)
CSCL 17I

A general description is given of the eight-station system at Havana which incorporated high-gain antennas and a powerful transmitter to reach faint meteors on the order of magnitude of plus 12. The station location, principle of system design, systems connections, transmitter, receivers, logics, range measurement, and recording are described. F.O.S.

N73-10833* Smithsonian Astrophysical Observatory, Cambridge, Mass.
SIMULTANEOUS OBSERVATIONS BY TELEVISION CAMERA AND RADAR c07
Richard E. McCrosky and J. T. Williams *In its* Meteor Res. Program Sep. 1972 p 29-36 (For availability see N73-10830 01-30)
CSCL 09E

The original image-orthicon equipment used for simultaneous radar and optical observations is described. The adaptations made to enhance its usefulness for meteor observations, and the specialized calibration and photometric procedures developed for this purpose are also described. Some brief comments concerning the use of the secondary electron conduction vidicon are included. F.O.S.

N73-10834* Smithsonian Astrophysical Observatory, Cambridge, Mass.
ANTENNA CALIBRATION AT HAVANA c07
Zdenek Sekanina and Richard B. Southworth *In its* Meteor Res. Program Sep. 1972 p 37-50 (For availability see N73-10830 01-30)
CSCL 09E

The procedures for calibrating the antenna patterns of the Havana radar system are described along with the reduction of the measurements made using a dipole towed behind an airplane. The power-gain pattern for the north, south, and joint troughs of sites 3 and 4 are plotted. F.O.S.

N73-10835* Smithsonian Astrophysical Observatory, Cambridge, Mass.
ANALYSIS PROCEDURE FOR RADAR OBSERVATIONS c07
Richard B. Southworth *In its* Meteor Res. Program Sep. 1972 p 51-68 refs (For availability see N73-10830 01-30)
CSCL 17I

Based on the assumption that the ionized column left behind a moving meteroroid is underdense, it is shown that radar observations of the column yield reasonable aproximations to the meteoriod's speed and trajectory. The principles and procedures for finding a meteor's position and vector velocity from the observed data are also presented. F.O.S.

N73-10836* Smithsonian Astrophysical Observatory, Cambridge, Mass.
ANALYSIS PROCEDURE FOR TELEVISION OBSERVATIONS AND SIMULTANEOUS OBSERVATIONS c07
Allan F. Cook, II *In its* Meteor Res. Program Sep. 1972 p 69-76 ref (For availability see N73-10830 01-30)
CSCL 09F

The procedures used in the analysis of television and simultaneous observations are described. Starting with the right ascension and declination of the meteor, the celestrial triangle formed by Sidell and the meteor is solved, and the epochs of the beginning and end of the meteor observation as recorded on the video tape are determined. F.O.S.

N73-10837* Smithsonian Astrophysical Observatory, Cambridge, Mass.
RESULTS FROM THE SYNOPTIC YEAR
Richard B. Southworth *In its* Meteor Res. Program Sep. 1972 p 77-82 refs (For availability see N73-10830 01-30)
CSCL 03B

The meteor data for the synoptic year are discussed. Statistics of observing times, masses, and orbits are included. F.O.S.

N73-10838* Smithsonian Astrophysical Observatory, Cambridge, Mass.
RESULTS FROM SIMULTANEOUS RADAR-TELEVISION OBSERVATIONS c07
Allan F. Cook, II, J. T. Williams, and C.-Y. Shao *In its* Meteor Res. Program Sep. 1972 p 83-99 refs (For availability see N73-10830 01-30)
CSCL 17I

The results of the reduction of simultaneous observations of 29 meteors are presented in tabular form. Fragmentation of the observations is discussed along with the 50 meteors not yet reduced. F.O.S.

N73-10839* Smithsonian Astrophysical Observatory, Cambridge, Mass.
HOURLY RATE DATA
Richard B. Southworth *In its* Meteor Res. Program Sep. 1972 p 101-103 refs (For availability see N73-10830 01-30)
CSCL 03B

The mass-dependent influx of meteors to the earth is discussed as the most important set of data for calculations of meteoroid hazard to spacecraft, and meteor distributions. The film recording of echo rates, and the echo analyzer are described along with the echo processor. F.O.S.

N73-10840* Smithsonian Astrophysical Observatory, Cambridge, Mass.
HEAD-ECHO DWTA
Richard B. Southworth *In its* Meteor Res. Program Sep. 1972 p 105-106 refs (For availability see N73-10830 01-30)
CSCL 03B

The observations of head echoes of meteoroids are briefly discussed. F.O.S.

N73-10841* Smithsonian Astrophysical Observatory, Cambridge, Mass.
SUPER-SCHMIDT METEORS
Richard E. McCrosky and C.-Y. Shao *In its* Meteor Res. Program Sep. 1972 p 107 ref (For availability see N73-10830 01-30)
CSCL 03B

The precise reduction program of photographic Super-Schmidt meteors is reported. A total of 314 meteors have been completely reduced, and about 40 meteors remain to be reduced. F.O.S.

N73-10842* Smithsonian Astrophysical Observatory, Cambridge, Mass.
ATOMIC AND MOLECULAR STUDIES
M. Raymond Flannery and Hiram Leby, II *In its* Meteor Res. Program Sep. 1972 p 109-113 refs (For availability see N73-10830 01-30)
CSCL 03B

The collisions of heavy particles were studied to increase the understanding of the collision of meteoroids with the upper atmosphere. The various methods applied to the development of theoretical models for determining collision processes responsible for ionization and excitation in the meteor collision are discussed. F.O.S.

N73-10843* Smithsonian Astrophysical Observatory, Cambridge, Mass.
DYNAMICS OF METEOR STREAMS AND NEW ASTEROID-METEOR AND COMET-METEOR ASSOCIATIONS
Zdenek Sekanina and Allan F. Cook, II *In its* Meteor Res. Program Sep. 1972 p 115-151 refs (For availability see N73-10830 01-30)
CSCL 03B

The orbital data on 19,303 meteors were analyzed in terms of the dynamics of meteor streams. A statistical model of meteor streams is discussed along with stream-search techniques, and associations of radio meteor streams with comets and minor planets. F.O.S.

N73-10844* Smithsonian Astrophysical Observatory, Cambridge, Mass.
ATTACHMENT A: A WORKING LIST OF METEOR STREAMS
Allan F. Cook, II *In its* Meteor Res. Program Sep. 1972 p 153-166 refs (For availability see N73-10830 01-30)
CSCL 03B

A list of 57 active meteor streams is presented. The orbital elements, daily motion, maximum visual zenithal rate, and maximum echoe rate are shown. F.O.S.

N73-10845*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
ATLAS/CENTAUR-29 INTELSAT IV (F5) FLASH FLIGHT REPORT
26 Jun. 1972 30 p
(NASA-TM-X-68649; KSC-TR-1184) Avail: NTIS HC $3.50
CSCL 22C

ATLAS/CENTAUR-29 was launched from ETR Complex 36B, June 13, 1972, at a flight azimuth of 101 degrees. The ETR test number was 1240. The launch vehicle consisted of an ATLAS SLV-3C first stage and a CENTAUR second stage. The spacecraft was INTELSAT 4 (F-5). The launch occurred at the opening of the window. Indications are that the spacecraft was injected into the required transfer orbit and has achieved it's final orbit. All orbital parameters were extremely close to nominal. A nominal apogee motor burn took place at 2101 EDT on June 14, 1972 at 124 degrees East longitude and the final duty station of the spacecraft will be at 62 degrees East longitude. A two week communications checkout was started on or about June 15, 1972. Author

N73-10846*# TRW Systems Group, Houston, Tex.
EARTH ORBIT NAVIGATION STUDY. VOLUME 2: SYSTEM EVALUATION Final Report, 25 Feb. - 25 Aug. 1972
25 Aug. 1972 184 p refs
(Contract NAS9-12475)
(NASA-CR-128582; TRW-21474-H007-R0-00-Vol-2) Avail: NTIS HC $11.25 CSCL 22A

An overall systems evaluation was made of five candidate navigation systems in support of earth orbit missions. The five systems were horizon sensor system, unkown landmark tracking system, ground transponder system, manned space flight network, and tracking and data relay satellite system. Two reference missions were chosen: a low earth orbit mission and a transfer trajectory mission from low earth orbit to geosynchron-

ous orbit. The specific areas addressed in the evaluation were performance, multifunction utilization, system mechanization, and cost. Author

N73-10847*# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.
APOLLO LUNAR SURFACE EXPERIMENTS PACKAGE Monthly Progress Review
Jul. 1972 80 p
(Contract NAS9-5829)
(NASA-CR-128580; BSR-3378) Avail: NTIS HC $6.00 CSCL 22A

The ALSEP program status and monthly progress are reported. Environmental and quality control tests and test results are described. Details are given on the Apollo 17 Array E, and the lunar seismic profiling, ejecta and meteorites, mass spectrometer, surface gravimeter, and heat flow experiments. Monitoring of the four ALSEP systems on the moon is also described. N.E.N.

N73-10848*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LUNAR COMPOSITION FROM APOLLO ORBITAL MEASUREMENTS
Isidore Adler, Jacob I. Trombka, Lo I. Yin, Paul Gorenstein, Paul Bjorkholm, and Jesse Gerald Sep. 1972 52 p refs Submitted for publication
(NASA-TM-X-66068; X-641-72-351) Avail: NTIS HC $4.75 CSCL 03B

Several spectrometers carried in the Service Module of the Apollo 15 and Apollo 16 spacecraft were employed for the compositional mapping of the lunar surface. The observations involved the measurements of secondary (fluorescent) X-rays, gamma rays and alpha particle emissions. A large scale compositional map of over 20 percent of the lunar surface was obtained for the first time. It was possible to demonstrate interesting chemical differences between the mare and the highlands, to find specific areas of high radioactivity and to learn something about the composition of the moon's hidden side. Further the same devices were used to obtain useful astronomical data during the return to earth. Author

N73-10849*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE PROPERTIES OF MATTER IN NEUTRON STARS
Gerhard Boerner Oct. 1972 62 p refs Submitted for publication
(NASA-TM-X-66067; X-660-72-391) Avail: NTIS HC $5.25 CSCL 03A

A review of recent development in the description of neutron star matter is presented, and its relevance to pulsar observations is discussed. This review is aimed at the astrophysicist. Author

N73-10850*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PULSAR OBSERVATIONS AND NEUTRON STAR MODELS
Gerhard Boerner and Jeffrey M. Cohen Oct. 1972 28 p refs Presented at 53d IAU Symp., Boulder, Colo., Aug. 1972 Submitted for publication
(NASA-TM-X-66066; X-660-72-390) Avail: NTIS HC $3.50 CSCL 03A

Information about the physical parameters of neutron stars is obtained from pulsar observations. The energy balance of the Crab nebula and the Vela X remnant allows derivation of limits for the masses of the Crab and Vela pulsars. Glitch observations provide further clues on the masses of these two pulsars. The degree of confidence in the derived numbers is pointed out. The possibility of observing neutron stars in binary systems as pulsating X-ray sources is discussed. The importance of observing redshifted gamma ray lines from the surface of neutron stars, and thus directly measuring either individual or statistical properties of these objects is pointed out. Author

N73-10851*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE HEATING OF INTERSTELLAR CLOUDS BY VIBRATIONALLY EXCITED MOLECULAR HYDROGEN
Theodore P. Stecher and David A. Williams Sep. 1972 15 p refs
(NASA-TM-X-66064; X-672-72-382) Avail: NTIS HC $3.00 CSCL 03B

The possibility that vibrationally excited H2 may be collisionally de-excited, so providing a heating mechanism for interstellar clouds which operates by coupling the stellar radiation to the gas, is discussed. The majority of excitations in the Lyman and Werner bands of H2 return the molecules to the ground electronic state in a vibrationally excited level, the most favored level being 7. The heating rate obtained in this way is compared with other mechanisms which have been postulated, and the results of calculations of temperature as a function of depth into clouds of different densities are presented. It appears that this mechanism is a significant one, which should be taken into account in detailed models of dense clouds. Author

N73-10852*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VLBI OBSERVATIONS OF THE CRAB NEBULA PULSAR
N. R. Vandenberg, T. A. Clark, W. C. Erickson, G. M. Resch, J. J. Broderick (Arecibo Obs.), R. G. Payne (Arecibo Obs.), S. H. Knowles (NRL, Washington, D. C.), and A. B. Youmans (NRL, Washington, D. C.) Oct. 1972 16 p refs
(NASA-TM-X-66071; X-693-72-381) Avail: NTIS HC $3.00 CSCL 03A

Observations were made at meter wave-lengths using very long base-line interferometry techniques. At 196.5 MHz no resolution of the pulsar are observed; all the pulse shapes observed with the interferometers are similar to single dish profiles, and all the power pulsates. At 111.5 MHz besides the pulsing power there is always a steady component, presumably due to interstellar scattering. The pulsar is slightly resolved at 111.5 MHz with an apparent angular diameter of 0.07 sec ± 0.01 sec. A 50 percent linear polarization of the time-averaged power is noted at 196.5 MHz; at 111.5 MHz, 20 percent of the total time-averaged power is polarized, 35 percent of the pulsing power is polarized, and the steady component is unpolarized. Author

N73-10853*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MOLECULAR BRANCHING RATIO METHOD FOR INTENSITY CALIBRATION OF OPTICAL SYSTEMS IN THE VACUUM ULTRAVIOLET
Michael J. Mumma Oct. 1972 33 p refs Submitted for publication
(NASA-TM-X-66070; X-691-72-371) Avail: NTIS HC $3.75 CSCL 03B

A state-of-the-art review is given of the molecular branching ratio method for intensity calibration in the vacuum ultraviolet. Ways are described for determining both relative and quantitative responses in the wavelength range 1000 A to 3000 A. The molecular band systems which are discussed are the following: H2(B 1 Sigma u +)-(X 1 Sigma g +), H2(C 1 Pi u)-(X 1 Sigma g +), N2(A 1 Pi g)-(X 1 Sigma g +), CO(A 1 Pi)-(X 1 Sigma +), NO(A 2 Sigma +)-(X 2 Pi r), and NO(+) (A 1 Pi)-(X 1 Sigma +). Author

N73-10854*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTRINSIC B-V COLOR FOR GALACTIC CEPHEIDS AND SOME COMMENTS ON THE SANDAGE-TAMMANN RELATIONSHIP
Thomas Kelsall Oct. 1972 29 p refs Submitted for publication
(NASA-TM-X-66061; X-641-72-365) Avail: NTIS HC $3.50 CSCL 03A

Transformations are found for converting the b-y color excesses for Cepheids given by Williams (1966) and Kelsall (1971) into B-V excesses. The combination of these results with the E(B-V)'s determined by Sandage and Tammann (1971) gives precise data for eighty-eight galactic Cepheids. The period-color and period-color-(amplitude defect) relationships, that are germane to the LogP intervals 0.4 to 1.4 and 0.4 to 1.3, respectively, are found. Author

N73-10855*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EFFECTS OF PERIGEE ROTATION ON ORBITAL FLUX INTEGRATION (PARTIAL, PRELIMINARY RESULTS)

E. G. Stassinopoulos Jun. 1972 7 p Submitted for publication
(NASA-TM-X-66059; X-601-72-211) Avail: NTIS HC $3.00 CSCL 22C

A preliminary quantitative evaluation of a nominal AE-C trajectory (65 deg inclination, 150 km perigee, 4000 km apogee, and eccentricity 0.228) is presented in terms of perigee rotation. Plots show the effects of the rotation on the levels of average, vehicle-encountered, orbit-integrated proton and electron fluxes for the specified trajectory. Author

N73-10856# Joint Publications Research Service, Arlington, Va.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 285
3 Oct. 1972 47 p Transl. into ENGLISH from Russian reports (JPRS-57162) Avail: NTIS HC $4.50

Translations and abstracts of articles are presented on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial geophysics, covering both science news and formal scientific reports. Published details of Soviet space spectaculars are included. Author

N73-10857*# Analytical Mechanics Associates, Inc., Seabrook, Md.
GENERATION OF NEP HELIOCENTRIC TRAJECTORY DATA
Jerry L. Horsewood and Katherine B. Brice Sep. 1972 53 p refs
(Contract NAS2-6946)
(NASA-CR-114491; AMA-72-43) Avail: NTIS HC $4.75 CSCL 22A

A study, designed to generate representative nuclear electric propulsion data for rendezvous missions to the comet Encke using the variational calculus program HILTOP, is presented. Other purposes of the study include a comparison of the HILTOP data with equivalent data generated with QUICKTOP program and to propose approaches for storing and subsequently accessing the optimum trajectory and performance data in the QUICKLY program. Author

N73-10858*# Scientific Translation Service, Santa Barbara, Calif.
PROBLEM OF THE VALUE OF THE LUNAR GRAVITATIONAL FIELD EXPANSION COEFFICIENTS C20 AND C22
Sh. T. Khabibullin and Yu. A. Chikanov Washington NASA Oct. 1972 5 p refs Transl. into ENGLISH from Astron. Zh. (Moscow), v. 49, no. 1, 1972 p 222-223
(Contract NASw-2035)
(NASA-TT-F-14605) Avail: NTIS HC $3.00 CSCL 03B

The discrepancy between the values of the C20 and C22 coefficients (which define the polar and equatorial flattening of the dynamic configuration of the moon) obtained by Gapcynski, Blackshear, and Compton (1969) and previous values obtained by Lorell and Sjogren (1968) and by Michael et al. (1969) is analyzed. It is proposed to calculate these coefficients on the basis of the most probable values of the Cassini-equator inclination and of the g (prime) parameter defining the radial density distribution in the bulk of the moon. Author

N73-10859*# Stanford Univ., Calif.
PROJECT CYCLOPS: A DESIGN STUDY OF A SYSTEM FOR DETECTING EXTRATERRESTRIAL INTELLIGENT LIFE
1972 253 p refs Sponsored by NASA
(NASA-CR-114445) Avail: NTIS HC $14.75 CSCL 03B

The requirements in hardware, manpower, time, and funding to conduct a realistic effort aimed at detecting the existence of extraterrestrial intelligent life are examined. The methods used are limited to present or near term future state-of-the art techniques. Subjects discussed include: (1) possible methods of contact, (2) communication by electromagnetic waves, (3) antenna array and system facilities, (4) antenna elements, (5) signal processing, (6) search strategy, and (7) radio and radar astronomy. Author

N73-10860*# National Aeronautics and Space Administration, Washington, D.C.
STUDY OF A SOLAR SONDE IN THE ECLIPTIC WITH AN APPROACH TO THE SUN TO WITHIN 0.26 AU
D. E. Koelle et al Sep. 1972 201 p refs Transl. into ENGLISH from report RF-77-ST of Boelkow GmbH, Ottobrun, West Germany, Nov. 1966 129 p
(NASA-TT-F-14700; RF-77-ST) Avail: NTIS HC $12.25 CSCL 03B

The feasibility of a solar sonde mission with a 0.26 AU perihelion was investigated. The scientific useful load, thrust requirements, construction, and possible carrier rockets are discussed along with earth-sun orbits, and design criteria. It is concluded that there is a high degree of probability of success for the solar sonde, and for launching, the Saturn 5 carrier rocket can be used. F.O.S.

N73-10861*# Techtran Corp., Glen Burnie, Md.
THERMAL SOUNDING EXPERIMENT BY THE METEOR ARTIFICIAL EARTH SATELLITE
L. A. Pakhomov, Yu. M. Timofeyev, V. G. Shklyarevskiy, and O. M. Pokrovskiy Washington NASA Jul. 1972 10 p refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 12, 1971 p 25-30
(Contract NASw-2037)
(NASA-TT-F-14493) Avail: NTIS HC $3.00 CSCL 22C

On the basis of the experiment with the spectrometer of the Central Aerological Observatory, installed aboard the Meteor satellite, a possibility of successful solution of the problem of temperature remote sounding with the aid of spectral measurements of medium resolution is demonstrated. The retrieval of a medium resolution is performed under conditions of a cloudless atmosphere as well as in overcast conditions. The prospect of methods of remote sounding under conditions of partial cloudiness is demonstrated. A statistical retrieval of the moisture profile is performed. Author

N73-10862*# Scientific Translation Service, Santa Barbara, Calif.
OCCULTATIONS OF STARS BY JUPITER
Jean Meeus Washington NASA Nov. 1972 10 p refs Transl. into ENGLISH from l'Astronomie (France), v. 86, May 1972 p 223-229
(Contract NASw-2035)
(NASA-TT-F-14626) Avail: NTIS HC $3.00 CSCL 03A

All occultations by Jupiter of stars brighter than magnitude 6.55 were calculated for the period from 1951 to 2000. The list of occultations includes the instant of geocentric conjunction at right ascension in ephemeris time, the difference between the declination of the star and that of the planet, the polar radius of the planet, and its horizontal parallax. For the theoretical calculation of the frequency of occultation of bright stars by Jupiter, the bright star density in the neighborhood of the ecliptic was first investigated. The brightest stars that could be occulted by Jupiter were then determined. Bright star occultations by other planets such as the Venus occultation of Regulus and of beta Scorpion are presented. Using the same reasoning for Uranus as for Jupiter, it is found that Uranus occults a star brighter than magnitude 6.55 on the average of once every 316 years. Author

N73-10863# Hamburger Sternwarte (West Germany).
SPECTROPHOTOMETRY OF GALACTIC NEBULAE MORPHOLOGICAL PROPERTIES OF THE ORION NEBULA CONCERNING THE DUST LANES IN HII-REGIONS Final Scientific Report
Karl A. Wurm 30 Jun. 1971 15 p refs
(Contract F61052-68-C-0058; AF Proj. 8635)
(AD-745314; AFCRL-72-0270) Avail: NTIS CSCL 03/2

The report discusses the following: The different more recent researches of the continuous emission in the Orion Nebula; Surface features clearly typical for the scattered continuum, others clearly typical for the Balmer line emission; Discussion of the observational results; and, A typical example of a dust lane in H2-regions. GRA

N73-10864# Joint Publications Research Service, Arlington, Va.
SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 286
12 Oct. 1972 69 p refs Transl. into ENGLISH from Russian report
(JPRS-57229) Avail: NTIS HC $5.50

Translations and abstracts of articles on meteorology, oceanography, upper atmosphere and space research, astronomy

and terrestrial geophysics, covering both science news and formal scientific reports are presented. Published details of Soviet space spectaculars are included. Author

N73-10865*# National Aeronautics and Space Administration, Washington, D.C.
IMPROVING THE ANALYTICAL REPRESENTATION OF THE GEOMAGNETIC FIELD ACCORDING TO SPUTNIK DATA
N. K. Osipov, L. O. Tiurmina, and G. N. Cherevko Jun. 1972 14 p refs Transl. into ENGLISH from Izv. Sibirsk. Otd. Akad. Nauk SSSR (Novosibirsk), no. 1, 1966 p 146-152
(NASA-TT-F-14446) Avail: NTIS HC $3.00 CSCL 03B

Component measurements of the geomagnetic field taken by the Sputniks are analyzed to solve a series of geophysical problems. Using the approximate iteration method, and assuming spherical harmonic progressions that represent the north, east, and vertical components of the geomagnetic field, a linear function is found for representing the difference between the measured, and calculated null coefficients. It is concluded that the results obtained on 420 points should be considered experimental, and the coefficients obtained are not recommended for surveys. F.O.S.

N73-10866*# Scientific Translation Service, Santa Barbara, Calif.
MESOSPHERIC CIRCULATION AND NOCTILUCENT CLOUDS
W. Schroeder Washington NASA Nov. 1972 8 p refs Transl. into English from Beitr. Geophys. (East Germany), v. 68, no. 3, 1969 p 209-213
(Contract NASw-2035)
(NASA-TT-F-14712) Avail: NTIS HC $3.00 CSCL 03B

Based upon routine observations of noctilucent clouds (LN) it is shown that no LN have been observed during the months October - March. This can be used for additional interpretation of LN physics and mesospheric circulation. A dependence between the mesospheric circulation and the corresponding LN data is shown. The times of wind transitions in the mesosphere in spring and autumn are important for the seasonal frequency of occurrence of LN clouds. They appear only in the summer circulation, which is limited by the times of wind transition in spring and autumn, respectively. In the summer months a low temperature has been measured in the mesosphere, which is in agreement with the lifting motion above 60 km. In winter (sinking motion above 60 km in the northern hemisphere) higher temperatures are observed and no clouds are noted. Author

N73-10867*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VELOCITY GRADIENTS AND MICROTURBULENCE IN CEPHEIDS
Alan H. Karp (Maryland Univ.) Oct. 1972 17 p refs
(NASA-TM-X-66081; X-672-72-397) Avail: NTIS HC $3.00 CSCL 03A

Vairations of the microturbulent velocity with phase and height in the atmosphere were reported in classical Cepheids. It is shown that these effects can be understood in terms of variations of the velocity gradient in the atmospheres of these stars. Author

N73-10868# Groupe de Recherches de Geodesie Spatiale, Paris (France).
[MOTION OF ARTIFICIAL SATELLITES]
Aug. 1972 63 p refs In FRENCH
(GRGS-Bull-5) Avail: NTIS HC $5.25

The analytical solution is presented for the influence of planetary gravitational effects on the motion of an artificial satellite. The earth, moon, and sun couplings are discussed, as well as long period and secular terms of the satellite equation of motion. For individual titles, see N73-10869 through N73-10870.

N73-10869 Groupe de Recherches de Geodesie Spatiale, Paris (France).
COMPUTED ANALYTICAL THEORY OF MOON AND SUN GRAVITATIONAL INFLUENCE ON THE MOTION OF ARTIFICIAL SATELLITES [THEORIE ANALYTIQUE PROGRAMMEE DE L'INFLUENCE GRAVITATIONNELLE DE LA LUNE ET DU SOLEIL DANS LE MOUVEMENT DES SATELLITES ARTIFICIELS]
Xavier Berger and Yves Boudon (Paris Obs., Meudon) *In its* Motion of artificial satellites Aug. 1972 p 1-28 refs In FRENCH; ENGLISH summary (For availability see N73-10868 01-30)

The analytic solution of the influence of a disturbing body on satellite motion permits a study of the resulting secular and long period perturbations and indicates which terms are most important. The study reveals, resonance terms. The coupling between the earth, moon and sun was also investigated, and its importance and applications are demonstrated. Author (ESRO)

N73-10870 Groupe de Recherches de Geodesie Spatiale, Paris (France).
ANALYTIC EXPRESSIONS OF SECULAR 2J3 AND LONG PERIOD 2J2 TERMS [EXPRESSIONS ANALYTIQUES DES TERMES SECULAIRES EN 2J3 ET A LONGUES PERIODES EN 2J2]
Xavier Berger *In its* Motion of artificial satellites Aug. 1972 p 29-58 refs In FRENCH; ENGLISH summary (For availability see N73-10868 01-30)

In the analytical theory of satellite motion around an oblate spheroid, the secular terms of order 2J3 and the long period terms of order 2J2 are the only nonnegligible terms that were not given. This development and the results are given, and a comparison with numerical integration confirms their accuracy. Author (ESRO)

N73-10871# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
[INTERSTELLAR MATTER AND SOLAR WIND]
Max Wallis Jun. 1972 54 p refs Submitted for publication
(TRITA-EPP-72-03) Avail: NTIS HC $4.75

Background Lyman-alpha observations from OGO 5 are interpreted in the interstellar wind picture, taking into account the radiative transfer problems. The interaction processes governing the penetration of the interstellar gas into the solar neighborhood are reexamined. For individual titles, see N73-10872 through N73-10873.

N73-10872 Royal Inst. of Tech., Stockholm (Sweden).
LOCAL HYDROGEN AND THE BACKGROUND LYMAN-ALPHA PATTERN
In its Interstellar Matter and Solar Wind Jun. 1972 p 1-18 refs Sponsored by UK Sci. Res. Council (For availability see N73-10871 01-30)

The background Lyman-alpha observations are interpreted on the interstellar wind picture, taking into account the radiation transfer problems. The intensity minimum is provided mainly by near-isotropic cavity radiation, while the anisotropic contribution derives from the asymmetric distribution of nearby gas inside the cavity. OGO 5's values for the maximum and minimum intensities lead to interstellar densities in excess of 0.1 H-atoms/cu cm and quite possibly as high as the 0.2 - 0.3/cu cm of independent local derivations. Collisional heating explains the absence of a subsidiary maximum, derived from gravitational focusing of cool gas. Author (ESRO)

N73-10873 Royal Inst. of Tech., Stockholm (Sweden).
INTERACTION BETWEEN THE INTERSTELLAR MEDIUM AND SOLAR WIND PLASMA
In its Interstellar Matter and Solar Wind Jun. 1972 p 21-51 refs Sponsored by UK Sci. Res. Council (For availability see N73-10871 01-30)

The interaction processes governing the penetration of the interstellar gas into the solar neighborhood are reexamined, as well as photoionization and charge exchange processes, proton elastic collisions and electron ionizations. Particle heating, particularly in the elastic collisions, determines the gas characteristics in the gravitationally focused tail-enhanced H-density. The He tail is effectively hotter than 1000 K. Termination of the solar wind is rediscussed in the light of both electron heating and the stronger gas interaction. The spiral interplanetary field is taken to breakup and the subsonic plasma flow to be controlled by the pressure of slowly cooling electrons. Author (ESRO)

N73-10874# Royal Greenwich Observatory, Herstmonceux (England). Time and Latitude Service.

GREENWICH TIME REPORT Quarterly Report, Oct. - Dec. 1971
R. vdRWolley Feb. 1970 16 p
Avail: NTIS HC $3.00

Results of Greenwich time and latitude observations for the period October through December 1971 are presented. Also included are radio time signals and standard frequency emissions. ESRO

N73-10875# Osservatorio Astrofisico, Asiago (Italy).
PHOTOMETRIC AND SPECTROSCOPIC STUDIES OF NOVAE AND SUPERNOVAE Final Report
L. Rosino Jan. 1972 18 p
(Contract AF 61(052)-887; AF Proj. 8635)
(AD-743955; AFCRL-72-0280) Avail: NTIS CSCL 03/2

The report gives the principal results of the spectroscopic and photographic researches on novae and supernovae carried out during the last five years at the Astrophysical Observatory of Asiago under the direction of the writer. GRA

N73-10876# California Inst. of Tech., Pasadena. Owens Valley Radio Observatory.
APERTURE SYNTHESIS STUDY OF NEUTRAL HYDROGEN IN THE GALAXIES NGC 6946 AND IC 342
D. H. Rogstad, G. S. Shostak, and A. H. Rots 1972 33 p refs
(Contract N00014-67-A-0094-0019)
(AD-744679; Rept-1972-4) Avail: NTIS CSCL 03/2

Synthesis observations of neutral hydrogen emission in the two spiral galaxies NGC 6946 and IC 342 are presented. The velocity resolution is 21 km/s and the angular resolution is 2 and 4 min of arc for NGC 6946 and IC 342 respectively. Results are presented in the form of contour maps of the integral and mean velocity of the HI profile at each position in the galaxy, as well as a line profile for each galaxy as a whole. Both galaxies evidence a central depression in their HI distributions. The rotation curves have steep central gradients with rather constant velocities once the maximal velocity is reached. The HI mass for NGC 6946 is 21 billion solar mass units and for IC 342 is 15 billion solar mass units, assuming distances of 10.1 and 4.5 Mpc respectively. Other properties are summarized in the table. Author (GRA)

N73-10877# Weather Wing (4th), Ent AFB, Colo.
BASIC NEUTRAL LINE PATTERNS DEFINING INTERPLANETARY DISCONTINUITIES
Arnold U. Starr Jun. 1972 12 p refs
(AD-745100; Rept-4WW-TM-72-3) Avail: NTIS CSCL 03/2

The report briefly describes certain chromospheric patterns which appear to show significant correlation with changes in the interplanetary and geomagnetic fields. Author (GRA)

N73-10878# Aerospace Corp., El Segundo, Calif. Lab. Operations.
A CATALOG OF TEN MICRON CELESTIAL OBJECTS Technical Report, Oct. 1971 - Mar. 1972
Richard T. Hall 1 Jun. 1972 72 p refs
(Contract F04701-71-C-0172)
(AD-743891; TR-0172(9260-01)-17; SAMSO-TR-72-118) Avail: NTIS CSCL 03/2

A catalog of 383 celestial objects reported to emit infrared radiation at or near 10 microns is given. This catalog is a compilation of observations reported in 55 articles in the open literature. The catalog lists the source name, its equatorial coordinates, and its infrared flux. Author (GRA)

N73-10879# Owens Valley Radio Observatory, Pasadena, Calif.
A MODEL OF THE CRAB NEBULA DERIVED FROM DUAL-FREQUENCY RADIO MEASUREMENTS
K. W. Weiler and G. A. Seielstad 1972 32 p refs
(Contract N00014-67-A-0094-0019)
(AD-744678; Rept-1972-3) Avail: NTIS CSCL 09/2

The total intensity and linearly polarized emission from the Crab Nebula (Taurus A) were synthesized to a resolution of approximately 1 arc-minute at both 1420 and 2880 MHz. From these data were calculated the spectral index, rotation measure, intrinsic position angle, and depolarization ratio distributions. Then, combined with a source model, the physical conditions within the supernova remnant were established. The strength and orientation of both the homogeneous and random components of the magnetic field were determined and a measurement of the thermal electron plasma distribution obtained. Author (GRA)

N73-10880# Harvard Radio Astronomy Station, Fort Davis, Tex.
STUDY OF THE RADIO FREQUENCY SPECTRUM OF THE SUN Final Report, 1 Apr. 1969 - 31 Jan. 1972
Alan Maxwell Apr. 1972 20 p
(Contract F19628-69-C-0033; AF Proj. 7649)
(AD-745167; AFCRL-72-0224) Avail: NTIS CSCL 03/2

The report summarizes programs carried out under AFCRL Contract F19628-69-C-0033 with Harvard University. The contract was written to promote research on the spectral characteristics of radio bursts from the sun. The report is divided into five main parts: (1) Introduction; (2) New equipment; (3) Scientific program; (4) Services to other research groups; (5) Radio interference at Fort Davis. Author (GRA)

N73-10881# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
GEODETIC APPLICATIONS OF SATELLITE-TO-SATELLITE TRACKING. PART 1: ANALYSIS
S. M. Yionoulis and V. L. Pisacane Feb. 1972 30 p refs
(Contract N00017-72-C-4401)
(AD-741683; APL-TG-1185-Pt-1) Avail: NTIS CSCL 22/3

The report is the first of a two-part study of the geodetic benefits to be derived from satellite-to-satellite tracking data. The report contains the necessary analytic expressions to be used in the simulation studies envisioned as part of the second phase. The equations for range and range rate between two satellites in orbit about the earth are complete through first order in the gravitational perturbing forces and include the effects of all powers in eccentricity. They are also completely general in that no assumptions are made as to a particular satellite pair configuration. Author (GRA)

N73-10882# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A COMPARISON OF THE GRADIENT AND NEWTON-RAPHSON TECHNIQUES FOR REENTRY TRAJECTORY OPTIMIZATION M.S. Thesis
William E. Henson and Gerald A. Robertson Jun. 1972 173 p refs
(AD-745998; GGC/EE/72-5) Avail: NTIS CSCL 22/3

The report contains a two-dimensional optimization analysis of reentry trajectories for minimization of space vehicle heating and maximization of terminal range, conducted for a lifting body reentry vehicle with a maximum lift-to-drag of three. Based on this analysis there appears to be a conflict between heat minimization and range maximization in that a high angle-of-attack is required to minimize the heating rate and a lower angle-of-attack is required to maximize range. Two optimization techniques were compared, a Newton-Raphson method and a steepest-descent gradient method. A modification of the gradient technique, which was based upon the variational Hamiltonian, was applied after convergence to a near-optimal solution, resulting in an improved control profile. Author (GRA)

N73-10987* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Mission Analysis Div.
A SUMMARY OF THE PIONEER 10 MANEUVER STRATEGY
R. B. Frauenholz and J. E. Ball *In its* JPL Quart. Tech. Rev., Vol. 2, No. 3 Oct. 1972 p 46-61 refs (For availability see N73-10981 01-34)
CSCL 22C

N73-10785* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EVIDENCE FOR CHANGES IN THE ANGULAR VELOCITY OF THE SURFACE REGIONS OF THE SUN AND STARS
In its Solar Wind 1972 p 276-286 refs (For availability see N73-10760 01-29)
CSCL 03A

N73-10786* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EVIDENCE FOR THE DISTRIBUTION OF ANGULAR VELOCITY INSIDE THE SUN AND STARS
In its Solar Wind 1972 p 287-306 refs (For availability see N73-10760 01-29)
CSCL 03A

N73-10787* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MICROSTRUCTURE OF THE INTERPLANETARY MEDIUM
L. F. Burlaga *In its* Solar Wind 1972 309-332 refs (For availability see N73-10760 01-29)
CSCL 03B

N73-10792* California Univ., Los Angeles. Dept. of Planetary and Space Science.
POWER SPECTRA OF THE INTERPLANETARY MAGNETIC FIELD NEAR THE EARTH
D. D. Childers and Christopher T. Russell *In* NASA. Ames Res. Center Solar Wind 1972 p 375-381 refs (For availability see N73-10760 01-29)
CSCL 03B

N73-10798* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A TWO-SPACECRAFT TEST OF A SINGLE SPACECRAFT METHOD OF ESTIMATING SHOCK NORMALS
Ronald P. Lepping *In its* Solar Wind 1972 p 444-452 refs (For availability see N73-10760 01-29)
CSCL 03B

N73-10799* National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
INTERPLANETARY DOUBLE-SHOCK ENSEMBLES WITH ANOMALOUS ELECTRICAL CONDUCTIVITY
Murray Dryer *In* NASA. Ames Res. Center Solar Wind 1972 p 453-471 refs (For availability see N73-10760 01-29)
CSCL 03B

N73-10804* National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
EVIDENCE FOR A CONTINUOUS, POWER LAW, ELECTRON DENSITY IRREGULARITY SPECTRUM
Willard M. Cronyn *In* NASA. Ames Res. Center Solar Wind 1972 p 517-520 refs (For availability see N73-10760 01-29)
CSCL 03B

N73-10813* Colorado Univ., Boulder. Dept. of Astro-Geophysics.
PROPERTIES OF NEARBY INTERSTELLAR HYDROGEN DEDUCED FROM LYMAN-alpha SKY BACKGROUND MEASUREMENTS
Gary E. Thomas *In* NASA. Ames Res. Center Solar Wind 1972 p 668-683 refs (For availability see N73-10760 01-29)
(Contract NAS5-9327; Grant NGR-06-003-052)
CSCL 03B

N73-10814* Los Alamos Scientific Lab., N.Mex.
INTERSTELLAR HELIUM IN INTERPLANETARY SPACE
William C. Feldman, J. J. Lange (Wright-Patterson AFB, Ohio), and Frank Scherb (Wisconsin Univ., Madison) *In* NASA. Ames Res. Center Solar Wind 1972 p 684-697 refs Sponsored in part by AEC (For availability see N73-10760 01-29)
(Grants NGL-50-002-044; NGR-50-002-162)
CSCL 03B

N73-10815* California Univ., Los Angeles. Dept. of Planetary and Space Science.
EFFECTS OF INTERSTELLAR PARTICLES UPON THE INTERPLANETARY MAGNETIC FIELD
Paul J. Coleman, Jr. and Edwin M. Winter *In* NASA. Ames Res. Center Solar Wind 1972 p 698-701 refs Sponsored in part by NSF (For availability see N73-10760 01-29)
(Grant NGL-05-007-004)
CSCL 03B

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also; 28 Propulsion Systems; and 32 Structural Mechanics.

N73-10883*# North American Rockwell Corp., Downey, Calif. Space Div.
MODULAR SPACE STATION PHASE B EXTENSION: MASS PROPERTIES Final Report
L. A. Duffey 5 Nov. 1971 130 p
(Contract NAS9-9953)
(NASA-CR-128409; SD-71-219; MSC-02472) Avail: NTIS HC $8.50 CSCL 22B

The MSS system, capable of supporting a six-man crew, is described as consisting of four common station modules, two special modules (core and power), and a cargo module arranged in a cruciform. The station buildup, and space station subsystems including environmental control life support, electrical power, guidance and control are also described. The MSS system weights are presented for design-to-weight, closeout weights, and shuttle payload weights. F.O.S.

N73-10884*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
STUDY OF STRUCTURAL ACTIVE COOLING AND HEAT SINK SYSTEMS FOR SPACE SHUTTLE Final Report
30 Jun. 1972 206 p refs
(Contract NAS8-27708)
(NASA-CR-123912; MDC-E0638) Avail: NTIS HC$12.50 CSCL 22B

This technology investigation was conducted to evaluate the feasibility of a number of thermal protection systems (TPS) concepts which are alternate candidates to the space shuttle baseline TPS. Four independent tasks were performed. Task 1 consisted of an in-depth evaluation of active structural cooling of the space shuttle orbiter. In Task 2, heat sink concepts for the booster were studied to identify and postulate solutions for design problems unique to heat sink TPS. Task 3 consisted of a feasibility demonstration test of a phase change material (PCM) incorporated into a reusable surface insulation (RSI) thermal protection system for the shuttle orbiter. In Task 4 the feasibility of heat pipes for stagnation region cooling was studied for the booster and the orbiter. Designs were developed for the orbiter leading edge and used in trade studies of leading edge concepts. At the time this program was initiated, a 2-stage fully reusable shuttle system was envisioned; therefore, the majority of the tasks were focused on the fully reusable system environments. Subsequently, a number of alternate shuttle system approaches, with potential for reduced shuttle system development funding requirements, were proposed. Where practicable, appropriate shifts in emphasis and task scoping were made to reflect these changes. Author

N73-10885# Institut d'Aeronomie Spatiale de Belgique, Brussels.
TABLES OF ARTIFICIAL SATELLITES, 1957 - 1971 [TABLEAU DES SATELLITES ARTIFICIELS, 1957 - 1971]
J. Vercheval 1972 121 p In FRENCH; ENGLISH summary
(F-22) Avail: NTIS HC $8.25

Artificial satellites launched from 1957 to 1971 are listed. The chronology of manned space flight and emission frequencies of various satellites are included. Author

N73-10886*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: STATIC STABILITY AND CONTROL INVESTIGATION OF NR/GD DELTA WING BOOSTER (B-20) AND DELTA WING ORBITER (134-D), VOLUME 3
E. C Allen, Jr. and F. W. Eder Sep. 1972 496 p
(Contract NAS8-4016)
(NASA-CR-119994-Vol-3; DMS-DR-1130-Vol-3) Avail: NTIS HC $27.00 CSCL 22B

Experimental aerodynamic investigations have been made on a .0035 scale model North American Rockwell/General Dynamics version of the space shuttle in the NASA/MSFC 14 x 14 Inch Trisonic Wind Tunnel. Static stability and control data were obtained on the delta wing booster alone (B-20) and with the delta wing orbiter (134D) mounted in various positions on the

booster. Six component aerodynamic force and moment data were recorded over an angle of attack range from -10 to 24 deg at 0 and 6 deg sideslip angles and from -10 to +10 deg sideslip at 0 deg angle of attack. Mach number ranged from 0.6 to 4.96. Author

N73-10887*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: STATIC STABILITY AND CONTROL INVESTIGATION OF NR/GD DELTA WING BOOSTER (B-20) AND DELTA WING ORBITER (134D), VOLUME 4
E. C. Allen, Jr. and F. W. Eder Oct. 1972 668 p
(Contract NAS8-4016)
(NASA-CR-119994-Vol-4; DMS-DR-1130-Vol-4) Avail: NTIS HC $35.50 CSCL 22B

Test results of booster and orbiter models of various component buildup configurations are reported. Dataset Collation Sheets, which give a complete summary of the configurations, are presented along with a description of the test facility. Data reduction procedures are described. F.O.S.

N73-10888*# Vought Missiles and Space Co., Dallas, Tex.
AERODYNAMIC CHARACTERISTICS OF THE SCOUT 133R VEHICLE DETERMINED FROM WIND TUNNEL TESTS
F. B. Abramson, T. G. Muir, and H. L. Simmons 26 Oct. 1972 93 p refs
(Contract NAS1-10900)
(NASA-CR-112175) Avail: NTIS HC $6.75 CSCL 22B

Bending moments and other associated parameters were measured on a Scout vehicle during a launch through high velocity horizontal winds. Comparison of the measured data with predictions revealed some unexplained discrepancies. Possible sources of error in the experimental data and predictions were considered; one of which is the predicted aerodynamic characteristics. A wind tunnel investigation was initiated, including supersonic force and pressure tests, to better define the aerodynamics. In addition to basic aerodynamic coefficients from the force test, detailed pressure and load distributions along the body were established from the pressure test. Pressure coefficients were integrated to determine normal load distributions, total normal force, and total pitching moment of the body. Comparison of the normal forces from pressure and force tests resulted in agreement within 15%. Comparison of pitching moment data from the two tests resulted in larger differences. Author

N73-10889*# Chrysler Corp., New Orleans, La.
SPACE SHUTTLE: A COMPARISON OF WIND TUNNEL FACILITY DATA ON THE GRUMMAN H-33 DELTA WINGED ORBITER
R. A. Gyorfi (Northrop Services, Inc.) and J. M. Rampy (Northrop Services, Inc.) Oct. 1972 73 p refs
(Contract NAS8-4016)
(NASA-CR-120080; DMS-SPR-0009) Avail: NTIS HC $5.75 CSCL 22B

A comparison of longitudinal and lateral directional stability and control characteristics of the Phase B Grumman H-33 orbiter configuration obtained from 6 tests conducted in 4 different facilities is presented. The H-33 orbiter configuration does not include drop tanks. Slope data are used as the medium for comparison. The slope data were computed using the SADSAC system and have been reduced to a common reference system. Data used for comparison were selected based on common configurations wherever possible. Where direct configuration comparisons were not possible, the parameters selected for comparison are regarded as insensitive to the noted differences. Factors considered in comparing the various data were scaling effects, balance operating ranges, balance sensitivities and control deflection accuracies. All factors considered, the comparison among data obtained from the various facilities is excellent. The minor differences in stability and control characteristics are well within the accuracy band of preliminary design model construction specifications. Author

N73-10890*# Boeing Co., Houston, Tex.
SPACECRAFT BOOST AND ABORT GUIDANCE AND CONTROL SYSTEMS REQUIREMENT STUDY, BOOST DYNAMICS AND CONTROL ANALYSIS STUDY. EXHIBIT A: BOOST DYNAMICS AND CONTROL ANLAYSIS Final Report
F. E. Williams, John B. Price, and R. S. Lemon 15 Sep. 1972 261 p refs
(Contract NAS9-12183)
(NASA-CR-128592) Avail: NTIS HC $15.25 CSCL 22B

The simulation developments for use in dynamics and control analysis during boost from liftoff to orbit insertion are reported. Also included are wind response studies of the NR-GD 161B/B9T delta wing booster/delta wing orbiter configuration, the MSC 036B/280 inch solid rocket motor configuration, the MSC 040A/LOX-propane liquid injection TVC configuration, the MSC 040C/dual solid rocket motor configuration, and the MSC 049/solid rocket motor configuration. All of the latest math models (rigid and flexible body) developed for the MSC/GD Space Shuttle Functional Simulator, are included. Author

N73-10891*# Georgia Inst. of Tech., Atlanta. School of Mechanical Engineering.
SPACE RADIATOR SIMULATION MANUAL FOR COMPUTER CODE
William Z. Black and Wolfgang Wulff Apr. 1972 364 p
(Contract NAS9-10415)
(NASA-CR-128594) Avail: NTIS HC $20.25 CSCL 22B

A computer program that simulates the performance of a space radiator is presented. The program basically consists of a rigorous analysis which analyzes a symmetrical fin panel and an approximate analysis that predicts system characteristics for cases of non-symmetrical operation. The rigorous analysis accounts for both transient and steady state performance including aerodynamic and radiant heating of the radiator system. The approximate analysis considers only steady state operation with no aerodynamic heating. A description of the radiator system and instructions to the user for program operation is included. The input required for the execution of all program options is described. Several examples of program output are contained in this section. Sample output includes the radiator performance during ascent, reentry and orbit. Author

N73-10892*# Georgia Inst. of Tech., Atlanta. School of Mechanical Engineering.
SIMPLIFIED ANALYSIS AND OPTIMIZATION OF SPACE BASE AND SPACE SHUTTLE HEAT REJECTION SYSTEMS
Wolfgang Wulff Apr. 1972 158 p refs
(Contract NAS9-10415)
(NASA-CR-128596) Avail: NTIS HC $10.00 CSCL 22B

A simplified radiator system analysis was performed to predict steady state radiator system performance. The system performance was found to be describable in terms of five non-dimensional system parameters. The governing differential equations are integrated numerically to yield the enthalpy rejection for the coolant fluid. The simplified analysis was extended to produce the derivatives of the coolant exit temperature with respect to the governing system parameters. A procedure was developed to find the optimum set of system parameters which yields the lowest possible coolant exit temperature for either a given projected area or a given total mass. The process can be inverted to yield either the minimum area or the minimum mass, together with the optimum geometry, for a specified heat rejection rate. Author

N73-10893*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
EVALUATION OF NONDESTRUCTIVE TESTING TECHNIQUES FOR THE SPACE SHUTTLE NONMETALLIC THERMAL PROTECTION SYSTEM
D. A. Tiede Jul. 1972 136 p refs
(Contract NAS9-12180)
(NASA-CR-128607; MDC-G3678) Avail: NTIS HC $9.00 CSCL 22B

A program was conducted to evaluate nondestructive analysis techniques for the detection of defects in rigidized surface insulation (a candidate material for the Space Shuttle thermal protection system). Uncoated, coated, and coated and bonded samples with internal defects (voids, cracks, delaminations, density variations, and moisture content), coating defects (holes, cracks, thickness variations, and loss of adhesion), and bondline defects (voids and unbonds) were inspected by X-ray radiography, acoustic, microwave, high-frequency ultrasonic, beta backscatter, thermal, holographic, and visual techniques. The detectability of

each type of defect was determined for each technique (when applicable). A possible relationship between microwave reflection measurements (or X-ray-radiography density measurements) and the tensile strength was established. A possible approach for in-process inspection using a combination of X-ray radiography, acoustic, microwave, and holographic techniques was recommended. Author

N73-10894*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: A COMPARISON OF WIND TUNNEL FACILITY DATA ON THE 040A SPACE SHUTTLE ORBITER CONFIGURATION
R. A. Gyorfi Oct. 1972 83 p refs
(Contract NAS8-4016)
(NASA-CR-120081) Avail: NTIS HC $6.25 CSCL 22B

A series of comparisons made on the longitudinal and lateral directional stability and control characteristics of the baseline 040A space shuttle orbiter configuration is documented. The data used for the comparisons were obtained from five wind tunnel tests conducted in four different wind tunnel facilities. The media for comparison were the aerodynamic slope values plotted as a function of Mach number for the different facilities. The slopes were computed using the SADSAC system and have been reduced relative to a common reference system. Data used for the comparison were selected based on a common baseline configuration. Identical configurations were available in all cases except MSFC 551 where an off-baseline vertical tail was tested. Some of the factors considered in comparing the various data were balance operating ranges and sensitivities, Reynolds number differences, scaling effects and control deflection accuracies. Author

N73-10895*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HYPERSONIC AEROTHERMAL CHARACTERISTICS OF A MANNED LOW FINENES RATIO SHUTTLE BOOSTER
Peter T. Bernot and David A. Throckmorton Washington Nov. 1972 45 p refs
(NASA-TM-X-2642; L-8453) Avail: NTIS HC $3.00 CSCL 22B

An investigation of a winged booster model having canards and an ascent configuration comprised of the booster mounted in tandem with an orbiter model has been conducted at Mach 10.2 in the continuous flow hypersonic tunnel. Longitudinal and lateral directional force characteristics were obtained over angle of attack ranges of -12 deg to 60 deg for the booster and -11 deg to 11 deg for the ascent configuration. Interference heating effects on the booster using the phase-change coating technique were determined at 0 deg angle of attack. Some oil flow photographs of the isolated booster and orbiter and ascent configuration are also presented. Author

N73-10896*# National Aeronautics and Space Administration, Washington, D.C.
CALCULATION OF THE DIRECTION OF MAGNETIC MOVEMENTS OF THE ESRO 1 SATELLITE
Sep. 1972 15 p Transl. into ENGLISH of Contraves AG, Zurich, Tech. Rept., TM-RES-581-39-008, dated 1 May 1967 10 p
(NASA-TT-F-14499; TM-RES-581-39-008) Avail: NTIS HC $3.00 CSCL 22B

The direction of the magnetic moment of the two permanent magnets in the ESRO-1 satellite was determined based on measurements of the three components of the magnetic field at various points. Author

N73-10897# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
ATTITUDE STABILITY AND PERFORMANCE OF A DUAL SPIN SATELLITE WITH LARGE FLEXIBLE APPENDAGES
D. B. Cherchas Oct. 1971 122 p refs
(AD-743258; UTIAS-170) Avail: NTIS CSCL 22/2

The attitude stability criteria and nutation decay times of a dual-spin satellite with a large flexible solar array are found in terms of significant satellite parameters. The equations of motion are developed from Hamilton's principle and then linearized, with solar array natural modes utilized as array degrees of freedom. It is shown that with proper mass balancing, the equations for spin variables can be decoupled from those for transverse variables. The linearized equations are numerically studied through the system eigenvalues thus yielding direct statements of stability and nutation damping time. These eigenvalue studies are done first assuming the array to be rigid and then with array flexibility included. A complementary analysis for the solar array develops practical information regarding array natural mode frequencies and shapes and boom buckling considerations. Author (GRA)

N73-10898# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BALLISTICS OF A ROCKET: CERTAIN PROBLEMS OF BALLISTICS OF LONG-RANGE ROCKETS
A. A. Lebedev and N. F. Gerasyuta 24 Mar. 1972 335 p refs Transl. into ENGLISH of the publ. "Ballistika Raket, Nekotoryye Zadachi Ballistiki Raket dalnego deystviya" Moscow Mashinostr., 1970 p 1-241
(AD-743687; FTD-MT-24-1176-71) Avail: NTIS CSCL 16/2

Methods for solving some problems in rocket ballistics of long-range are examined. Attention is given to the interaction of the various parts of the rocket and the control system. Examined are flight conditions for rockets, peculiarities of rockets as a controlled mechanical system, general equations of rocket movement, adjustment data for firing, ultimate range, dynamics of start and processes of division, dynamics of the uncontrolled head part, scattering of rockets, selection of nominal trajectory. GRA

N73-10899# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Space Systems Center.
PROTON ACTIVATED RECESSION SENSOR (PARS), VOLUME 2 Final Report
A. J. Armini, S. N. Bunker, K. Burkhard, and L. H. Levin May 1972 146 p ref
(Contract F04701-68-C-0288)
(AD-745454; MDC-G2924-Vol-2; SAMSO-TR-72-108-Vol-2) Avail: NTIS CSCL 16/3

The program investigated the migration of Be7 radioactive sources within graphite. Data on the implantation of the Be7 sources and other studies were documented in Volume I of this report. The migration phenomena seen in that earlier work are reviewed and summarized in this report. Additional high-temperature tests were performed and one possible method of inhibiting diffusion was investigated. These investigations showed that diffusion of Be7 in graphite appears to occur at temperatures above approximately 4,000 F and can be sufficiently understood to permit evaluating feasibility of a shape-change system using Be7 in graphite as a function of trajectory and geometry. The Be7 proton-activated recession sensor (PARS) concept was tested for (1) ablation, (2) source mobility effects, and (3) extreme temperature and pressure distribution. Author (GRA)

N73-10900# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
ON OPTIMIZING THE DESIGN OF SPACE-BASED TRANSPORTATION SYSTEMS
R. C. Oliver and R. G. Finke Oct. 1971 65 p refs
(Contract DAHC15-67-C-0011)
(AD-744979; P-796; IDA/HQ-71-12919) Avail: NTIS CSCL 22/2

The factors involved in selecting propulsion stages to give minimum costs for future space-based transportation systems are outlined. A parametric procedure is described for selecting such minimum cost vehicles and applied to generalized and specific (lunar exploration and geostationary transfer) missions. The results indicate the different regimes wherein reusable and expendable vehicles (or mixes thereof) in single- or two-stage versions should give minimum costs. The results also show that for preferred configurations the costs of space transportation are essentially proportional to earth-to-orbit costs. Author (GRA)

N73-10901# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
APPLICATION OF SUB-OPTIMAL CONTROL TO MISSILE INTERCEPT PROBLEMS M.S. Thesis
Edward F. Stafford Jun. 1972 137 p refs
(AD-746005; GGC/EE/72-16) Avail: NTIS CSCL 15/7

The study was to determine the feasibility of applying sub-optimal control to synthesize a feedback controller for the

two-dimensional, non-linear, air-to-air intercept and pursuit-evasion problems. A number of the sub-optimal techniques was investigated, but only one was determined to be applicable to the intercept problem. The selected method is based upon the linearization of the system dynamics, and then the sub-optimal control law is determined using conventional optimal control. Further, the solution procedure is repeated periodically, since the linear model is assumed representative of the actual system for short periods of time. Author (GRA)

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N73-10902 Engineering Sciences Data Unit, London (England).
ELASTIC STRESS CONCENTRATION FACTORS. SINGLE REINFORCED AND UNREINFORCED HOLES IN INFINITE PLATES OF ISOTROPIC MATERIALS
May 1970 36 p Supersedes ESDU-Struct-02.04.03, ESDU-66003, and ESDU-65004 Sponsored by Roy. Aeron. Soc.
(ESDU-70005; ESDU-Struct-02.04.03; ESDU-66003; ESDU-65004) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

Data on stress concentration effects that occur around holes in the flat plates under various combinations of loads in their plane are reported. Data apply strictly to infinite plates but are applicable to finite plates if their width is at least three times the overall dimension of the hole or its reinforcement. Considered data are for isotropic materials that obey Hooke's law, but may be used without significant error for most engineering materials. Author

N73-10903 Engineering Sciences Data Unit, London (England).
INFORMATION ON THE USE OF DATA SHEETS 01.06
May 1971 2 p Sponsored by Roy. Aeron. Soc.
(ESDU-01.06.00) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

Two types of data sheet section are considered, namely flanged and circular, and the effect of direct load on the maximum permissible bending moment is shown. The 0.5 percent proof stress was taken to be the maximum permissible stress level, although for convenience the form factor was related to the 0.2 percent proof stress. Author

N73-10904 Engineering Sciences Data Unit, London (England).
BENDING MOMENT AT CENTRE OF A STRUT DUE TO INITIAL CURVATURE
May 1971 3 p Sponsored by Roy. Aeron. Soc.
(ESDU-01.01.12) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

The strut is considered as bending in the plane of initial curvature under the combined action of end loads and equal restraining moments all acting in the plane of bending. The end restraining moments arise from the stiffness of the structure to which the strut is attached at its ends. The coefficient lambda is the elastic moment per radian deflection in the plane of bending exerted at the strut ends by the supporting structure and its attachment to the strut. Author

N73-10905 Engineering Sciences Data Unit, London (England).
FATIGUE STRENGTH OF LARGE STEEL SCREW THREADS UNDER AXIAL LOADING
1 Nov. 1968 8 p refs Sponsored by Roy. Aeron. Soc. and the Institution of Mech. Engr.
(ESDU-68045) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

Fatigue strength data is presented in the form of curves obtained from the results of 160 fatigue tests on solid steel bolts and studs with nominal thread diameter equal to or greater than 1.5 in. The curves represent the ratio of the alternating stress, based on core area, to the tensile strength of the material plotted against endurance. All the tests were carried out at room temperature under a fluctuating tensile load and the results plotted reflect five different methods of thread manufacture. D.L.G.

N73-10906 Engineering Sciences Data Unit, London (England).
FATIGUE STRENGTH OF STEEL SCREW THREADS WITH LARGE ROOT RADII UNDER AXIAL LOADING
Mar. 1969 8 p refs Sponsored by Roy. Aeron. Soc. and the Institution of Mech. Engr.
(ESDU-67020-Amend-A) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

Fatigue tests to determine the strength of steel screw threads with large root radii under axial loading are discussed. All tests were carried out at room temperature with a fluctuating tensile load. All failures occurred in the threaded portion of the bolt just inside the nut, close to the loaded face. Results of the tests are presented in the form of standardized curves. Author

N73-10907 Engineering Sciences Data Unit, London (England).
THE DESIGN OF CROSSED FLEXURE-PIVOTS
Sep. 1967 43 p refs Sponsored by Inst. of Mech. Engr.
(ESDU-67021) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

The capabilities of crossed flexure-pivots are described, and detailed guidance is given on the design of flexure-pivots whose strips cross midway along thier lengths and at right angles to each other. Data are appended for flexure-pivots whose strips do not cross midway along their lengths and at right angles to each other. Author

N73-10908 Engineering Sciences Data Unit, London (England).
STATIC STRENGTH OF SCREWED FASTENERS
Jan. 1967 15 p refs Sponsored by Inst of Mech. Engr.
(ESDU-67019) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

An analysis of about 1300 laboratory tensile tests on axially loaded screwed fasteners was made. Data on the tensile and stripping strengths of the fasteners are presented in terms of the probability of failure. Author

N73-10909 Engineering Sciences Data Unit, London (England).
GEOMETRIC STRESS CONCENTRATIONS CAUSED BY TWO EQUAL UNREINFORCED CIRCULAR HOLES IN INFINITE FLAT PLATES
Sep. 1969 12 p ref Sponsored by Roy. Aeron. Soc. and the Institution of Mech. Engr.
(ESDU-67023-Amend-A) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

Geometric stress concentrations caused by two equal unreinforced circular holes in infinite flat plates are analyzed. Mathematical models of a typical situation are presented. Curves are included to show range of values for various conditions. Author

N73-10910 Engineering Sciences Data Unit, London (England).
FATIGUE STRENGTH OF THICK CYLINDERS UNDER INTERNAL PRESSURE
Feb. 1967 6 p refs Sponsored by Roy. Aeron. Soc. and the Institution of Mech. Engr.
(ESDU-67014) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

Fatigue strength data are presented in the form of curves obtained from fatigue tests on steel and aluminum alloy cylinders. The cylinders were pressurized with oil and supported the axial pressure loads by tension in the walls. Failure was judged to have occurred when oil from the interior started to leak through the walls. The curves represent the ratio of maximum elastic shear stress to the tensile strength of the material, plotted against endurance. D.L.G.

N73-10911 Engineering Sciences Data Unit, London (England).
ELASTIC STRESSES IN THE TORISPHERICAL HEAD OF A PRESSURE VESSEL OF UNIFORM THICKNESS
Nov. 1967 18 p refs Sponsored by the Institution of Mech. Engr.
(ESDU-67017) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

Curves are given for determining the maximum and minimum (maximum compressive) stresses due to uniform pressure for an unpierced torispherical head closure to a cylindrical shell of the same thickness. The curves relate equally to shells under internal or external pressure. Tables of data, curves, and mathematical models are included for additional clarity. Author

N73-10912 Engineering Sciences Data Unit, London (England).
ELASTIC STRESSES IN A LONG CIRCULAR CYLINDRICAL SHELL WITH A FLAT HEAD CLOSURE UNDER UNIFORM PRESSURE
Mar. 1966 15 p refs Sponsored by the Institution of Mech. Engr.
(ESDU-66010) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

Curves are given which enable the maximum stresses to be determined for a long circular cylindrical shell with a flat head closure under uniform pressure only. The curves relate equally to shells under internal or external pressure. The curves apply only to stresses within the elastic range of the material. It is assumed that there is no relative movement between the shell and the head at the junction. Author

N73-10913 Engineering Sciences Data Unit, London (England).
LOADED PINS IN AXIALLY LOADED BARS. MAXIMUM ELASTIC STRESS AT HOLE BOUNDARY
May 1971 9 p refs Sponsored by the Institution of Mech. Engr.
(ESDU-66011-Amend-A) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

A method is given for determining the maximum shear stress at the hole boundary in an axially loaded bar with an additional axially aligned load entering via a pin in the hole. The pin may be either a push or interference fit in the hole. In either case the maximum stress occurs on the hole boundary at, or very near to, the transverse diameter. Author

N73-10914 Engineering Sciences Data Unit, London (England).
DESIGN AGAINST FATIGUE, DESIGN PRINCIPLES
May 1971 12 p refs Sponsored by the Institution of Mech. Engr.
(ESDU-71009) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

General design principles which should be observed to minimize the risk of fatigue failure in structures and components are summarized. Fatigue crack, stress in a component, reduction of stress concentration and range, choice of material, surface treatments, and fretting are considered. N.E.N.

N73-10915 Engineering Sciences Data Unit, London (England).
DESIGN AGAINST FATIGUE, BASIC DESIGN CALCULATIONS
Jun. 1970 27 p refs Sponsored by the Institution of Mech. Engr.
(ESDU-71010) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

A method is given for estimating the fatigue strength of components subjected to constant amplitude with constant mean loading, or loading that can be regarded as such. The method applies primarily to the design of components in rotating and reciprocating machinery but is generally applicable provided that: (1) The component is not subjected to frequent loads higher than the normal running loads. (2) The design endurance is greater than about 100,000 cycles. For shorter endurances the life may be affected by the crack propagation characteristics of the material and of the component geometry. Author

N73-10916 Engineering Sciences Data Unit, London (England).
STRESSES DUE TO INTERFERENCE-FIT PINS AND BUSHES IN PLATES, STRIPS OR LUGS
May 1971 11 p refs Supercedes in part ESDU-65004 Sponsored by Roy. Aeron. Soc. and Inst. of Mech. Engr.
(ESDU-71011; ESDU-65004) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

Data are presented on the elastic stresses arising in flat plates, bars, strips or lugs from the insertion of a circular interference-fit pin or bush of similar or different material. The data are based upon two-dimensional analyses and therefore only give the average stress through the thickness of the plate or strip. The data apply strictly to isotropic materials that obey Hooke's law, but may be used without significant error for most engineering materials. Author

N73-10917 Engineering Sciences Data Unit, London (England).
GUIDE TO THE USE OF THE STRESS AND STRENGTH SUB-SERIES
Jul. 1971 20 p
(ESDU-SS1) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

Guide is presented to help users of data items in the Stress and Strength Sub-series to employ them to the best advantage. The Stress and Strength Sub-series are useful in engineering design. With practice, and used with intelligence, its range of application will be wide. Author

N73-10918 Engineering Sciences Data Unit, London (England).
GUIDE TO ITEMS AVAILABLE IN OTHER SERIES
A. G. R. Thomson Jul. 1971 16 p
(ESDU-SS2) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

Items selected in the aeronautical structures sub-series deal with theoretical stress analysis of a particular configuration under given loading conditions with the analysis substantiated by tests. Considered are stress-strain and tangent modulus data of materials, sectional constants for calculating strength and buckling behavior of structural members, frames, and panels under loads, and the behavior of plate or panel structures subjected to kinetic heating arising from supersonic flight. G.G.

N73-10919 Engineering Sciences Data Unit, London (England).
GEOMETRIC STRESS CONCENTRATION FACTORS, TWO ADJACENT UNREINFORCED CIRCULAR HOLES IN INFINITE FLAT PLATES
Nov. 1966 10 p Sponsored by Roy. Aeron. Soc.
(ESDU-66035) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

The calculation of the geometric stress concentration factors in two adjacent unreinforced circular holes in infinite flat plates is discussed. Five different loading conditions were investigated. Standardized curves are developed to show variations in stress concentration. It was determined that a discontinuity in the curves or in their slope indicates an abrupt change in position of maximum stress. Author

N73-10920 Engineering Sciences Data Unit, London (England).
ELASTIC STRESSES IN SINGLE LAP JOINTS UNDER TENSION OR COMPRESSION
Feb. 1967 7 p ref Sponsored by Roy. Aeron. Soc. and Inst. of Mech. Eng.
(ESDU-67008) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

The maximum total elastic stress resulting from the combination of the bending stress and the applied direct stress in a single lap joint between two flat or curved plates of the same thickness and material are given for joints in compression, and joints in tension. F.O.S.

N73-10921 Engineering Sciences Data Unit, London (England).
NOTES ON THE INFLUENCE OF FRETTING ON FATIGUE
Jun. 1967 9 p refs Sponsored by the Roy. Aeron. Soc. and the Institution of Mech. Engr.
(ESDU-67012) Copyright. Avail: On subscription from

Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

The term fretting relates to the damaging interaction which occurs between two surfaces which are held in contact and caused to rub over one another with oscillatory motion of small amplitude. When the damage, as is usual, includes oxidation, it is described as fretting corrosion. Fretting of metals can result from contact with nonmetals but contact between two metals is the more common source of trouble in engineering practice. From tests in the laboratory as well as from general experience it seems that fretting will occur between all metal pairs, whether like or umlike, though its severity varies with different pairs. In unlike pairs one metal, usually but not always the softer, may be more severely fretted than the other. Author

N73-10922 Engineering Sciences Data Unit, London (England).
GUIDE TO ITEMS ON STRUTS, BEAMS AND SHAFTS
Jul. 1971 15 p refs
(ESDU-SS3) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

A guide is provided for using the data on the effects of buckling and deflections in struts, beams, and shafts. Elastic, local, and shear buckling are considered. The material proof stress and the material tangent modulus are also described. N.E.N.

N73-10923 Engineering Sciences Data Unit, London (England).
ELASTIC STRESSES AND DEFLECTIONS FOR FLAT CIRCULAR PLATES WITH D/t GREATER THAN OR EQUAL TO 4 UNDER UNIFORM PRESSURE
Sep. 1965 13 p refs Sponsored by the Institution of Mech. Engr. and the Roy. Aeron Soc.
(ESDU-65002) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

Curves are given which enable the maximum stresses and deflection to be determined for initially flat circular plates of uniform thickness under uniform pressure, with various edge conditions. The curves apply only to stresses within the elastic range of the material. Curves are given for thin plates, thick plates, and plates with edges elastically restrained against rotation. Author

N73-10924 Engineering Sciences Data Unit, London (England).
ELASTIC STRESSES AND DEFLECTIONS FOR FLAT CIRCULAR PLATES WITH D/t GREATER THAN OR EQUAL TO 20 UNDER UNIFORM PRESSURE
Sep. 1965 18 p ref Sponsored by Roy. Aeron. Soc. and the Institution of Mech. Engr.
(ESDU-65003) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

Curves are given which enable the maximum deflection and stresses to be determined for initially flat circular plates under uniform pressure, with various edge conditions. The curves apply only to stresses within the elastic range of the material. Author

N73-10925 Engineering Sciences Data Unit, London (England).
STRESS CONCENTRATION DATA
Jun. 1971 7 p refs Sponsored by Roy. Aeron. Soc. and the Institution of Mech. Engr.
(ESDU-65004-Amend-A-B-C) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

Data are presented on stress concentration effects arising from discontinuities of shape, or from inclusions or because of local load distributions. The definitions used in these sheets are given. The data apply only to isotropic materials that obey Hooke's Law. However, the majority of engineering materials are approximately isotropic and data sheets of this item may be used without significant error. Poisson's ratio is assumed to be 1/3 for all data calculations which require it but which do not include it in their notation. In such cases it is expected that its variation between 0.2 and 0.5 will produce less than + or - 5 per cent variation in the resulting stress concentration factor. Where it is practical to do so, limiting curves or values are presented to allow interpolation of near limit cases. Author

N73-10926 Engineering Sciences Data Unit, London (England).
ELASTIC STRESSES AND DEFLECTIONS OF HELICAL COMPRESSION SPRINGS OF ROUND WIRE
Sep. 1965 22 p refs Sponsored by Inst. of Mech. Engr.
(ESDU-65005) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

The elastic stresses and deflections of helical compression springs of round wire are described. The subjects discussed are: (1) maximum static shear stress, (2) rate and deflection effects, and (3) stress increase due to cyclic loading. Mathematical models are included to clarify the procedures. Author

N73-10927 Engineering Sciences Data Unit, London (England).
NOTES ON DESIGN OF HELICAL COMPRESSION SPRINGS OF ROUND WIRE
Sep. 1965 10 p refs Sponsored by Inst. of Mech. Engr.
(ESDU-65006) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

The factors which affect the selection of round wire for constructing helical compression springs are described. The subjects discussed are: (1) choice of material, (2) operational reliability, (3) corrosion effects (4) working temperature, (5) prestressing, and (6) choice of design working stress. Methods for determining the optimum design are presented. Procedures for producing the coil springs are analyzed. Author

N73-10928 Engineering Sciences Data Unit, London (England).
CLASSIFICATION OF THE DATA SHEETS ON STRUCTURES ISSUED PRIOR TO 1965
7 Jul. 1970 1 p Sponsored by Roy. Aeron. Soc.
(ESDU-00.00.01) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

A classification of data sheets issued by the Engineering Sciences Data Unit of Great Britain is presented. The two basic classifications are: (1) classification of structural components and (2) classification of load conditions. Examples are provided to indicate the method for classifying documents and the standard content of the documents. Author

N73-10929# Lockheed Missiles and Space Co., Palo Alto, Calif.
RANDOM SEARCH METHOD OF ANALYZING MINIMUM WEIGHT RIB-REINFORCED CYLINDRICAL SHELLS SUBJECTED TO EXTERNAL PRESSURE
V. I. Mossakovskii and Iu. M. Pochtman 1972 4 p refs Transl. into ENGLISH from Dopov. Akad. Nauk Ukr. RSR, Ser. A (Kiev), no. 5, 1972 p 457-460
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A method for selecting parameters of reinforcing ribs and fuselage members to assure minimum structural weight commensurate with strength and stability requirements is discussed. The problem is reduced to one of partial integral nonlinear programming and the use of a random search method. An example is given of a circular cylindrical shell which is reinforced by equidistant ribs of rectangular cross section and identical stiffness under external pressure. Mathematical models are included to define the limits imposed by a variety of conditions. Author

N73-10930# Lockheed Missiles and Space Co., Palo Alto, Calif.
VIBRATIONS OF A LUMPED MASS ON A RING CONNECTED TO A THIN SHELL
V. F. Zhizhov 1972 4 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Aviats. Tekh. (Kazan), no. 1, 1972 p 51-54
Avail: NTIS HC $3.00; National Translation Center, John Crerar Library, Chicago, Ill. 60616

The combined strain of a ring and a thin shell is analyzed to determine the natural frequency of vibration of the complex system. The natural frequency for one lumped mass located on a ring connected to a thin shell can be found in the plane of the ring. In this case the square of the frequency of angular motion is inversely proportional to the lumped mass and a pliability coefficient, which is the displacement of points of the middle line of the ring under the effect of a unit normal force. The natural frequencies are found for the cases in which the ring with the mass is connected to a spherical shell and to a cylindrical

shell. The results of an experimental investigation using a thin cylindrical shell are given. Author

N73-10931*# Mechanical Technology, Inc., Latham, N.Y.
DEVELOPMENT OF PROCEDURES FOR CALCULATING STIFFNESS AND DAMPING PROPERTIES OF ELASTOMERS IN ENGINEERING APPLICATIONS. PART 1: VERIFICATION OF BASIC METHODS
Thomas Chiang, Juergen M. Tessarzik, and Robert H. Badgley 31 Mar. 1972 111 p refs
(Contract NAS3-15334)
(NASA-CR-120965; MTI-72TR20) Avail: NTIS HC $7.75 CSCL 20K

The primary aim of this investigation was verification of basic methods which are to be used in cataloging elastomer dynamic properties (stiffness and damping) in terms of viscoelastic model constants. These constants may then be used to predict dynamic properties for general elastomer shapes and operating conditions, thereby permitting optimum application of elastomers as energy absorption and/or energy storage devices in the control of vibrations in a broad variety of applications. The efforts reported involved: (1) literature search; (2) the design, fabrication and use of a test rig for obtaining elastomer dynamic test data over a wide range of frequencies, amplitudes, and preloads; and (3) the reduction of the test data, by means of a selected three-element elastomer model and specialized curve fitting techniques, to material properties. Material constants thus obtained have been used to calculate stiffness and damping for comparison with measured test data. These comparisons are excellent for a number of test conditions and only fair to poor for others. The results confirm the validity of the basic approach of the overall program and the mechanics of the cataloging procedure, and at the same time suggest areas in which refinements should be made. Author

N73-10932# Boston Univ., Mass.
NONLINEAR INTERACTION OF PANEL FLUTTER WITH HARMONIC FORCING EXCITATION
Ching-Chiang Kuo, Luigi Morino, and John Dugundji (MIT) 18 Aug. 1972 49 p refs Backup document for AIAA Synoptic scheduled for publication in the AIAA Journal in Mar. 1973
(Contract F44620-69-C-0091)
Avail: NTIS HC $4.50

The interaction characteristics of harmonic forcing excitation and panel flutter are studied analytically. Both linear and nonlinear solutions are investigated. Wide ranges of dynamic pressure and forcing frequency are covered such that subcritical responses (pure forced response), supercritical response (forcing-flutter interaction), and the Coexistence of both pure forced response and forcing-flutter interaction are studied. Results obtained by both harmonic balance method and direct integration method generally agree well. Author

N73-10933*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF EXPERIMENTALLY MEASURED PRESSURE OSCILLATIONS ON THE VIBRATION OF A SOLID ROCKET MOTOR
James A. Schoenster and Harold B. Pierce Washington Nov. 1972 46 p refs
(NASA-TN-D-6931; L-8417) Avail: NTIS HC $3.00 CSCL 20K

Results are presented of firing a Nike rocket against a backstop for the purpose of obtaining pressure fluctuations in the rocket case and determining their relationship to structural vibrations of the case. Special care was required to obtain these pressure fluctuations because of the much higher static pressure generated in the rocket. Very small pressure fluctuations within the rocket case can cause significant vibration levels. A previously observed high frequency was shown to decrease with time before completely disappearing at about 1 second of burning time. The vibration of the case itself is probably related to the longitudinal structural modes at frequencies below 500 Hz and is dependent on local structural conditions at frequencies above this value. Author

N73-10934*# George Washington Univ., Washington, D.C.
SCATTER FACTOR AND RELIABILITY OF AIRCRAFT STRUCTURES
G. I. Schueller and A. M. Freudenthal Washington NASA Nov. 1972 43 p refs
(Grant NGR-09-010-058)
(NASA-CR-2100) Avail: NTIS HC $3.00 CSCL 14D

The concept of time to first failure is utilized to perform a parameter study of scatter factors of aircraft structures. The Weibull distribution is used for estimation of characteristic and certifiable lives. Scatter factors for various Weibull-shaped parameters, fleet sizes and level of reliabilities are calculated. It is concluded that the currently used range of scatter factors (2 through 4) is too narrow for the estimation of a safe life and that a safe and economical design for structural materials with shape parameters less than 2 does not seem feasible except for very small fleet sizes and low levels of reliability. Author

N73-10935# Sandia Labs., Livermore, Calif.
APPLICATION OF THE METHOD OF POTENTIAL TO STRESS SINGULARITIES IN TWO- AND THREE-DIMENSIONAL ELASTIC AND THERMOELASTIC STRESS FIELDS
A. F. Emery (Washington Univ., Seattle) and G. E. Walker, Jr. (Washington Univ., Seattle) Mar. 1972 50 p refs
(Contract AT(29-1)-789)
(SCL-DR-710026) Avail: NTIS

The method of potential is based upon Love's original singular solution for point loads applied to infinite media and was applied to some two- and three-dimensional problems under limited boundary conditions. The applicability of this method to three-dimensional stress problems in which a void or an inclusion creates local stress singularities is studied and the applicability of the method to problems of fracture mechanics is determined. Author

N73-10936# Royal Aircraft Establishment, Farnborough (England).
THE ENERGY-ABSORBING EFFICIENCY OF PLY-TEAR WEBBINGS OF VARIOUS CONSTRUCTIONS
J. E. Swallow, M. Webb, and Shirley A. Watts Jun. 1972 30 p refs
(RAE-TR-72051; BR-29365) Avail: NTIS HC $3.50

Twelve ply-tear webbings, woven to study the effects of warp and weft count and binder properties on the energy absorption per unit mass of webbing, were torn at slow speed and in dynamic conditions up to 10 m/s. Main warp breakage occurred with certain constructions and conditions; however, an efficiency of 40 j/g at a mass fraction of 0.08 for binders and 0.3 for weft appeared reasonably safe for the conditions tested. Author (ESRO)

N73-10937# Royal Armament Research and Development Establishment, Fort Halstead (England). Trials and Environmental Testing Dept.
THE RESONANCE-ENVELOPE RANDOM VIBRATION TEST
J. P. Salter and I. G. Roskilly Jun. 1972 56 p refs
(RARDE-Memo-18/72; BR-29757) Avail: NTIS HC $5.00

A resonance-envelope random vibration test was developed in order to assess the ruggedness of service equipment and sub assemblies. It covers the frequency band from 20 to 2000 Hz and is applicable to articles weighing up to 80 kg. Its performance characteristics are described and compared with those of the test employing sinusoidal motion. The superiority of the test employing random motion is shown by selecting one of three recommended levels of severity and by specifying the temperature at which it is to be carried out. Author (ESRO)

N73-10938# Wisconsin Univ., Madison. Mathematics Research Center.
NONLINEAR BUCKLED STATES OF RECTANGULAR PLATES
George H. Knightly and D. Sather Jun. 1972 27 p refs
(Contract DA-31-124-ARO(D)-462; Grant NSF GP-19712)
(AD-744993; MRC-TSR-1230) Avail: NTIS CSCL 20/11

A constructive method is developed to establish the existence of buckled states of a thin, flat elastic plate that is rectangular in shape, simply supported along its edges, and subjected to a constant compressive thrust applied normal to its two short edges. Under the assumption that the stress function and the deformation of the plate are described by the nonlinear von Karman equation,

the approach used yields information regarding not only the number of buckled states near an eigenvalue of the linearized problem, but also the continuous dependence of such states on the load parameter and the possible selection of that buckled state preferred by the plate. Author (GRA)

N73-10939# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NONALGORITHMIC METHODS FOR INVESTIGATION OF PROBLEMS OF MECHANICS OF DEFORMABLE SYSTEMS
V. M. Kondratev 21 Apr. 1972 306 p refs Transl. into ENGLISH of the book "Nealgoritmicheskie Metody Issled. Probl. Mekhan. Deformiruemykh Sistem' Kiev, 1968 p 1-212
(AF Proj. 1370)
(AD-745426; FTD-MT-24-96-71) Avail: NTIS CSCL 20/11

The book presents the theoretical principles of nonalgorithmic methods for investigating the strength, oscillations, and static and dynamic stability of linear and nonlinear rods and continuous systems using electronic models. The simulation of mechanical systems using electronic models of directional action and using reversible computers is considered. The book broadly presents physically and geometrically nonlinear systems, the calculation of which is performed on the basis of the method of direct simulation of nonlinear objects and the implementation of the method of flexible solutions using models. Author (GRA)

N73-10940# Washington Univ., Seattle. Dept. of Mechanical Engineering.
CRACK BRANCHING IN HOMALITE-100 SHEETS Interim Report
A. S. Kobayashi, B. G. Wade, W. B. Bradley, and S. T. Chiu Jun. 1972 33 p refs
(Contract N00014-67-A-0103-0018; NR Proj. 064-478)
(AD-744661; TR-13) Avail: NTIS CSCL 20/11

Crack branching in Homalite-100 sheets of 1/8-inch and 3/8-inch thickness was studied by using dynamic photoelasticity. Dynamic stress intensity factors, crack velocities and branching angles were measured. Corresponding static stress intensity factors were determined by the method of finite element analysis. Dynamic stress intensity factors reached a peak value at branching with a value of three times larger than the fracture toughness of the material and preceded the actual branching. The dynamic stress intensity factor after branching drops and then increases again to the maximum stress intensity at which point branching occurs again. Roughness of the fracture surface can be related to dynamic stress intensity factor and crack velocities near the branching stress intensity factors and terminal crack velocities, respectively. Average branching angle was 26 degrees.
Author (GRA)

N73-10941# Mechanics Research, Inc., Albuquerque, N.Mex.
STRUCTURAL CONFIGURATION FOR EXPEDIENT PAVEMENT SYSTEMS Technical Report, May - Dec. 1971
Robert E. Crawford, Ronald B. McPherson, Charles G. Utton, Laverne E. Romesberg, and Charles L. Schreyer Kirtland AFB, N. Mex. AFWL Apr. 1972 135 p refs
(Contract F29601-71-C-0082; AF Proj. 683M)
(AD-743958; AFWL-TR-71-148) Avail: NTIS CSCL 13/2

Four pavement concepts utilizing a fiberglass reinforced polyester (FRP) wearing a surface are presented as candidates for expedient air field pavement systems. Three of the conceptual systems utilize FRP as the material for the substructure configuration. The fourth system employs an aluminum honeycomb. Parametric studies relating structural response characteristics to system weight were performed to establish optimum configuration geometries for each of the four systems. Results of this preliminary study indicate that each conceptual system satisfies the criteria of an expedient pavement. Author (GRA)

N73-10942# California Univ., Berkeley. Div. of Applied Mechanics.
THE INFLUENCE OF THE REFERENCE GEOMETRY ON THE RESPONSE OF ELASTIC SHELLS
M. M. Carroll and P. M. Naghdi Jun. 1972 38 p refs
(Contract N00014-69-A-0200-1008; NR Proj. 064-436)
(AD-745291; AM-72-2) Avail: NTIS CSCL 13/13

Within the scope of the nonlinear theory of an elastic Cosserat surface, the report is mainly concerned with the influence of the reference geometry and the related aspects of material symmetry restriction on the response of thermoelastic shells. The significance of the effect of the reference geometry is discussed in the case of isotropic shells, which may be of variable thickness in a reference state. Author (GRA)

N73-10943# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
SUMMARY OF TEST RESULTS FOR ALUMINUM ALLOY BOX BEAM FATIGUE PROGRAM, TEST PHASES 1-4 Final Report
William Breyan 8 Jun. 1972 44 p refs
(AD-744673; NADC-72056-VT) Avail: NTIS CSCL 01/3

The results of a four-phase fatigue program for bending tests of 7075-T6 aluminum alloy box beams for positive loads only and for positive and negative loads for both constant-and variable-load amplitudes are presented. The relative damaging effect of four airplane flight-maneuver-loads spectra was determined, and the effects on fatigue life for variations in spectrum block size, stress level, stress direction, and load sequence were established and the results are discussed. When compared to full-scale aircraft structures of like material under constant-amplitude unidirectional loading on a percent of ultimate strength basis the beams represented the upper bound of those data for full-scale structures and exhibited similar fatigue characteristics. The beams were thus established as a suitable idealized structure for the investigation of those parameters which affect the structural fatigue life. Author (GRA)

N73-10944# California Univ., Los Angeles. Dept. of Materials.
STUDIES RELATING TO THE STRUCTURAL DYNAMIC BEHAVIOR OF LAMINATED PLATES AND SHELLS
Stanley B. Dong May 1972 164 p refs
(Contract N00014-71-C-0056; NR Proj. 064-519)
(AD-745336; UCLA-ENG-7236) Avail: NTIS CSCL 13/13

A number of studies related to structural dynamic behavior of laminated orthotropic plates and shells are reported. The plate or shell structure is composed of an arbitrary number of bonded elastic orthotropic layers, whose principal elastic axes coincide with the coordinate axes. These studies are based on two main approaches to the problem, viz., formulations by shell theory and by linear elasticity theory. Author (GRA)

N73-10945# Naval Ship Research and Development Center, Annapolis, Md.
MONITORING STRESS WAVE EMISSIONS
Hendrikus H. Vanderveldt Jun. 1972 45 p refs
(SF51541009)
(AD-745729; NSRDC-3809) Avail: NTIS CSCL 14/2

Basic principles of the acoustic-emission technique used at the Center are discussed, and a review of some applications of the method are presented. Potential capabilities and drawbacks to naval applications are summarized; finally, a description of the design and construction of the present monitoring capability at the Naval Ship Research and Development Center is presented. Author (GRA)

N73-10946# Washington Univ., Seattle. Dept. of Mechanical Engineering.
CRACK PROPAGATION AND ARREST IN IMPACTED PLATES
A. S. Kobayashi and B. G. Wade Jul. 1972 28 p refs
(Contract N00014-67-A-0103-0018; NR Proj. 064-478)
(AD-745792; TR-14) Avail: NTIS CSCL 20/11

Crack propagation and arrest in impacted, edge-cracked, tension plates composed of Homalite-100 sheets were studied by dynamic photoelasticity. Dynamic stress intensity factors, crack velocities and dynamic stress concentrations at the arresting hole were determined and compared with corresponding static values which were computed by the method of finite element analysis. Significant influence of the reflected stress waves generated by the impact was noticed in this investigation. The otherwise stable crack appeared to run intermittently when the dynamic stress intensity factor exceeded the static fracture toughness of the material. The static stress field surrounding the arresting hole appeared relatively ineffective in influencing the path of crack propagation. Conclusions reached in this investigation are similar to those published previously except for the more

pronounced stress wave effects in these series of experiments.
Author (GRA)

N73-10947# Harry Diamond Labs., Washington, D.C.
NORMAL MODE ANALYSIS OF A FUZE SUPPORT STRUCTURE USING NASTRAN, PART 1
William L. Fourney, John T. Crawley, and R. Richard Palmisano Apr. 1972 37 p
(DA Proj. 1X2-63302-D-212)
(AD-743879; HDL-TR-1581) Avail: NTIS CSCL 16/3

A support structure for a proposed guided missile electronic fuze was designed with the aid of the NASA Structural Analysis (NASTRAN) finite element structural analysis program. Two differently mounted mock-up fuze models were fabricated and tested under a sinusoidal 2-g load applied in the transverse, as well as the axial, direction. Good correlation was obtained between the values of natural frequency measured experimentally and those obtained from the digital computer program.
Author (GRA)

N73-10948# Army Foreign Science and Technology Center, Charlottesville, Va.
PERIODIC DIRICHLET PROBLEMS AND THE PLANAR THEORY OF ELASTICITY, PART 2
D. I. Sherman 26 Jan. 1972 12 p refs Transl. into ENGLISH from Uch. Zap. Azerb. Gos. Univ., Ser. Fiz.-Mat. Nauk (Baku), no. 6, 1966 p 58-63
(AD-741924; FSTC-HT-23-314-72-Pt-2) Avail: NTIS CSCL 20/11

It is demonstrated that the periodic problem of the theory of elasticity studies in the first part of this work can also be studied by a method presented in earlier sections as applicable to the Dirichlet problem.
Author (GRA)

N73-10949# Southwest Research Inst., San Antonio, Tex.
DAMPING OF VIBRATIONS OF CLAMPED FLAT PLATES Interim Technical Report, May 1969 - Jun. 1972
S. Silverman, W. E. Woolman, P. A. Cox, Jr., and W. E. Baker Jun. 1972 56 p refs
(Contract DA-31-124-ARO(D)-356; DA Proj. 200-14501-B-33-G)
(AD-746054; AROD-5615-4-E) Avail: NTIS CSCL 01/3

The results of damping experiments for flat, square plates vibrating in air and in vacuum are reported. The data include measured damping for plates of several materials and thicknesses, excited to resonance in each of a number of different modes. Two types of material damping and acoustic radiation damping to the air were included in equations of motion for plate vibration, and approximate solutions obtained for comparison with experiment. Agreement between these theoretical predictions and measured damping was poor. Although differences in measured and predicted material damping can possibly be attributed to energy losses in the plate clamping arrangement, similar differences in air damping cannot be easily explained.
Author (GRA)

N73-10950# Naval Ship Research and Development Center, Bethesda, Md.
METHODS FOR COMPUTING RADIATION DAMPING AND THE VIBRATORY RESPONSE OF FLUID LOADED AND ACOUSTICALLY RADIATING FINITE RECTANGULAR PLATES SUBJECT TO TURBULENCE EXCITATION, OPTION 4
Ralph C. Leibowitz Mar. 1972 210 p refs
(AD-746460; NSRDC-2976D) Avail: NTIS CSCL 13/10

Various methods are presented for computing the radiation damping of thin finite rectangular plates immersed in heavy and light fluid media. Based upon the results, preferred methods of computation are recommended. These methods and corresponding computer program--Option 4--are of particular value in extending previously formulated digital computer programs for obtaining the vibroacoustic response to turbulence excitation of a plate. Computer results are given for a particular case including the effect of both radiation damping and fluid loading on the vibratory response of a plate subject to turbulence excitation.
Author (GRA)

N73-10951# ARA, Inc., West Covina, Calif.
RESEARCH ON ENERGY ABSORBING STRUCTURES, PART 10 Final Scientific Report
Bernard Maxelsky, Robert R. Hewitt, T. H. Lin, and Sheng-Rong Lin Feb. 1972 102 p refs
(Contract F44620-71-C-0043; AF Proj. 9782)
(AD-746046; ARA-145-Pt-10; AFOSR-72-0714TR) Avail: NTIS CSCL 13/13

An analytical method for predicting the elastic-plastic bending of rectangular plates with large deflection is studied. The effects of plastic strain and large deflection on plate deformation are shown to be the same as a set of applied external forces on the plate in the classical elastic small deflection theory. For the plate considered, the deflection is increased only slightly by plastic strain; however, the maximum extreme fiber stress is considerably relieved by plastic yielding. A method is developed for a solution of the stress field in a semi-infinite elastic-plastic medium under a generalized plane deformation. The slip field and the build-up of local plastic strain at the free surface under cyclic loading are calculated. This local plastic strain build-up is used as the criterion for estimating early fatigue damage. Active slip on secondary slip systems is considered during fatigue cycling.
Author (GRA)

N73-10952# Stanford Univ., Calif. Dept. of Applied Mechanics.
VARIATIONAL PRINCIPLES IN DYNAMIC THERMOVISCOELASTICITY Interim Report
Subrata Mukherjee Apr. 1972 44 p refs
(Contract N00014-67-A-0112-0060; NR Proj. 064-471)
(AD-746466; SU-DAM-72-3) Avail: NTIS CSCL 20/11

Dual variational principles for steady state wave propagation in three dimensional thermoviscoelastic media are presented. The first one, for the equations of motion, involves only the complex displacement function. The second principle is for the energy equation. The specialized versions of these principles in two-dimensional polar coordinates and then in one dimension are obtained. A one-dimensional example, that of wave propagation in a thermoviscoelastic rod insulated on its lateral surface and driven by a sinusoidal stress at one end, is solved using the Rayleigh-Ritz method. The displacement and temperature functions are expressed as series of polynomials. Successive approximations for the solution are compared with a solution obtained by a method of finite differences, and an estimate of the degree of accuracy as a function of the number of terms taken in the series is obtained.
Author (GRA)

N73-10983* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Engineering Mechanics Div.
AN ALGORITHM FOR SYNTHESIZING MASS AND STIFFNESS MATRICES FROM EXPERIMENTAL VIBRATION MODES
R. G. Ross, Jr. *In its* JPL Quart. Tech. Rev., Vol. 2, No. 3 Oct. 1972 p 12-21 refs (For availability see N73-10981 01-34)
CSCL 20K

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N73-10953 Engineering Sciences Data Unit, London (England).
THERMAL CONDUCTIVITY OF LIQUID ALCOHOLS
Apr. 1967 9 p refs Sponsored by Inst. of Chem. Engr. and Inst. of Mech. Engr.
(ESDU-67030) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

Thermal conductivity data are given for liquid alcohols at their saturation pressure. The alcohols considered are monohydric alcohols derived from alkanes. The data are presented in both tabular and graphic forms.
D.L.G.

N73-10954 Engineering Sciences Data Unit, London (England).
THERMAL CONDUCTIVITY OF WATER SUBSTANCE
Nov. 1971 26 p refs Sponsored by the Institution of Chem. Engr. and the Institution of Mech. Engr.
(ESDU-67031-Amend-A) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

Tables and graphs of the thermal conductivity of water phases are presented. The conductivities for solid, liquid, and gaseous water and deuterium oxide are included. F.O.S.

N73-10955 Engineering Sciences Data Unit, London (England).
THERMAL CONDUCTIVITY OF LIQUID ALIPHATIC HYDROCARBONS
Oct. 1967 17 p refs Sponsored by Inst. of Chem. Engr. and Inst. of Mech. Engr.
(ESDU-67018) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Sgreet, London W1R 7AD

The thermal conductivity of liquid aliphatic hydrocarbons is discussed. The hydrocarbons considered are: (1) alkanes (paraffins) with saturated straight or branched chain carbons and (2) alkenes (monoolefins) with unsaturated straight or branched chain hydrocarbons having one double bond. The subjects discussed are conversion factors, thermal conductivity at saturation pressure, and the effect of pressure. The data are condensed in the form of graphs to show the thermodynamic properties under various conditions. Author

N73-10956 Engineering Sciences Data Unit, London (England).
THERMAL CONDUCTIVITY OF LIQUID HALOGENATED ALIPHATIC HYDROCARBONS INCLUDING COMMERCIAL REFRIGERANTS
Jan. 1971 52 p refs Sponsored by the Institution of Chem. Engr. and the Institution of Mech. Engr.
(ESDU-68024-Amend-A; ESDU-68024-Amend-B) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

The thermal conductivity properties of halogenated aliphatic hydrocarbons and commercial refrigerants are presented. Tables of data are prepared to show the recommended name, synonym, chemical formula, normal melting point, normal boiling point, and the critical temperature. Graphs are included to give a condensed presentation of the thermodynamic properties of the hydrocarbons investigated. Author

N73-10957 Engineering Sciences Data Unit, London (England).
SPECIFIC HEAT CAPACITY AT CONSTANT PRESSURE OF WATER SUBSTANCE: ICE, WATER AND STEAM, SOLID, LIQUID AND GASEOUS HEAVY WATER, AND SEA WATER
Mar. 1968 36 p refs Sponsored by Inst. of Mech. Engr. and Inst. of Chem. Engr.
(ESDU-68008) Copyright. Avail: On subscription from Engineering Sciences Data Unit, 251-259 Regent Street, London W1R 7AD

Tables and graphs for the specific heat capacity of water at constant temperature and pressure are presented. The specific heat capacities are included for solid, liquid and gaseous H2O, D2O, and sea water. F.O.S.

N73-10958*# Illinois Univ., Urbana. Heat Transfer Lab.
A NUMERICAL INVESTIGATION OF FILM COOLING AS AN ALTERNATE THERMAL PROTECTION SYSTEM FOR SPACECRAFT DURING ATMOSPHERIC REENTRY Final Report
A. M. Clausing and P. L. Kong Aug. 1972 63 p refs
(Grant NGR-14-005-138)
(NASA-CR-112192; ME-TR-138-2) Avail: NTIS HC $5.25 CSCL 20M

Research was undertaken to determine the mass required to protect a surface during atmospheric reentry by injecting a cold gas tangentially along the surface. A consideration of this problem revealed that the boundary layer equations could be employed to approximate the most important flow configurations which occur in film cooling. However, even with this simplification, the equations to be solved are complex, nonlinear, coupled partial differential equations. Due to the relative weakness of classical methods of boundary layer analysis, finite difference methods were chosen as the best approach to the formidable problem under consideration. Instead of blindly adopting a proposed technique and trying to force it to the problem, a more systematic study was deemed to be not only desirable but necessary. A relatively basic study of the application of finite difference methods was undertaken with the objective of developing an algorithm capable of obtaining accurate solutions to film cooling problems. Author

N73-10959*# Douglas Aircraft Co., Inc., Santa Monica, Calif. Aero/Thermodynamics Section.
PROTUBERANCE HEATING TEST PROGRAM
W. D. Sieker Feb. 1966 147 p refs
(Contract NAS7-101)
(NASA-CR-128400; SM-47497) Avail: NTIS HC $9.50 CSCL 20M

Results are presented of the protuberance heating test program. Four general protuberance shapes on a flat plate were tested. Presentation and evaluation of the data both on the protuberance and in the wake regions are made. The test program is an extension of the general protuberance heat transfer test. The additional series of tests was conducted to define the extent of wake heating and to assess the effects of Reynolds number variation on heating both on and around the protuberances. The protuberance models were mounted near the forward end of a six-foot instrumented test plate with stringers that simulated interstage and skirt structure of the Saturn S-4B stage. The tests were performed at Mach numbers of 2.49, 3.51, and 4.44. Reynolds numbers per foot of 3 million and 1.5 million were used for the two lower Mach numbers and 3 million for a Mach number of 4.44. The test Mach numbers simulated the Saturn S-4B flight conditions during the most severe aerodynamic heating period. The test Reynolds numbers were somewhat higher than the flight values, but lower values could not be used because of tunnel and instrumentation limitations. Oil flow runs were made on two representative models at various combinations of Mach number and Reynolds number to help define the extent of wake heating. Author

N73-10960# European Atomic Energy Community, Ispra (Italy).
CODE TAFE: NUMERICAL ANALYSIS OF THERMAL PROBLEMS IN THE PRESENCE OF RADIATION AND TEMPERATURE-DEPENDENT THERMAL CONDUCTIVITIES
J. Donea and S. Giuliani May 1972 47 p refs In FRENCH; ENGLISH summaries
(EUR-4809-f) Avail: NTIS HC $4.50

A numerical method of analysis and the associated computer program are presented for the solution of thermal problems. The method is based on the finite element technique. Plane and axisymmetric situations can be investigated. A complete description of the input data is included, as well as numerical examples. Author

N73-10961*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTIVE THERMAL CONDUCTIVITIES OF FOUR METAL CERAMIC COMPOSITE COATINGS IN HYDROGEN-OXYGEN ROCKET FIRINGS
Ralph L. Schacht, Harold G. Price, Jr., and Richard J. Quentmeyer Washington Nov. 1972 43 p refs
(NASA-TN-D-7055; E-7035) Avail: NTIS HC $3.00 CSCL 20M

An experimental investigation was conducted to determine the effective conductivities of four plasma-arc-sprayed, metal-ceramic gradated coatings on hydrogen-oxygen thrust chambers. The effective thermal conductivities were not a function of pressure or oxidant-to-fuel ratio. The various materials that made up these composites do not seem to affect the thermal conductivity values as much as the differences in the thermal conductivities of the parent materials would lead one to expect. Contact resistance evolving from the spraying process seems to be the controlling factor. The thermal conductivities of all the composites tested fell in the range of 0.75 to 7.5 watts per meter kelvin. Author

N73-10962*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF ORIENTATION OF THE ACCELERATION

VECTOR ON BURNING-RATE AUGMENTATION
G. Burton Northam Washington Nov. 1972 23 p refs
(NASA-TN-D-6952; L-8454) Avail: NTIS HC $3.00 CSCL 21B

The functional dependence of acceleration-induced burning-rate augmentation on the magnitude and orientation of the acceleration vector was determined for an aluminized composite propellant by using a slab motor mounted at various angles on a centrifuge. The rate augmentation was strongly dependent on the orientation of the acceleration vector with respect to the burning propellant surface. Author

N73-10963*# Vought Missiles and Space Co., Dallas, Tex.
MODULAR THERMAL ANALYZER ROUTINE, VOLUME 1
J. A. Oren, M. A. Phillips, and D. R. Williams 27 Mar. 1972 261 p refs
(Contract NAS9-4776)
(NASA-CR-128593; Rept-00.1524-Vol-1) Avail: NTIS HC $15.25 CSCL 20M

The Modular Thermal Analyzer Routine (MOTAR) is a general thermal analysis routine with strong capabilities for performing thermal analysis of systems containing flowing fluids, fluid system controls (valves, heat exchangers, etc.), life support systems, and thermal radiation situations. Its modular organization permits the analysis of a very wide range of thermal problems for simple problems containing a few conduction nodes to those containing complicated flow and radiation analysis with each problem type being analyzed with peak computational efficiency and maximum ease of use. The organization and programming methods applied to MOTAR achieved a high degree of computer utilization efficiency in terms of computer execution time and storage space required for a given problem. The computer time required to perform a given problem on MOTAR is approximately 40 to 50 percent that required for the currently existing widely used routines. The computer storage requirement for MOTAR is approximately 25 percent more than the most commonly used routines for the most simple problems but the data storage techniques for the more complicated options should save a considerable amount of space. Author

N73-10964*# Georgia Inst. of Tech., Atlanta. School of Mechanical Engineering.
SPACE RADIATOR SIMULATION SYSTEM ANALYSIS
William Z. Black and Wolfgang Wulff Apr. 1972 177 p refs
(Contract NAS9-10415)
(NASA-CR-128595) Avail: NTIS HC $11.00 CSCL 22B

A transient heat transfer analysis was carried out on a space radiator heat rejection system exposed to an arbitrarily prescribed combination of aerodynamic heating, solar, albedo, and planetary radiation. A rigorous analysis was carried out for the radiation panel and tubes lying in one plane and an approximate analysis was used to extend the rigorous analysis to the case of a curved panel. The analysis permits the consideration of both gaseous and liquid coolant fluids, including liquid metals, under prescribed, time dependent inlet conditions. The analysis provided a method for predicting: (1) transient and steady-state, two dimensional temperature profiles, (2) local and total heat rejection rates, (3) coolant flow pressure in the flow channel, and (4) total system weight and protection layer thickness. Author

N73-10965*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SHOCK TUBE STUDY OF THE REACTION H PLUS O2 PLUS Ar YIELDS HO2 PLUS Ar
Casimir J. Jachimowski and William M. Houghton Washington Nov. 1972 14 p refs
(NASA-TN-D-6990; L-8456) Avail: NTIS HC $3.00 CSCL 20M

Rate coefficient data for the recombination reaction H + 02 + Ar yields H02 + Ar have been determined from studies of lean hydrogen-oxygen mixtures behind incident shock waves over the temperature range of 948 to 1125 K. Hydroxyl radical concentration profiles were measured by ultraviolet absorption spectroscopy, and rate data were obtained through analysis of induction time and exponential growth parameter data. Analysis of the data yielded a rate coefficient which was generally lower than most of the more recent values obtained from shock tube studies. The effect of boundary layer formation on the conditions behind the shock was also examined and found to be negligible. Author

N73-10966*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF PROPELLANT COMPOSITION VARIABLES ON ACCELERATION-INDUCED BURNING-RATE AUGMENTATION OF SOLID PROPELLANTS
G. Burton Northam Nov. 1972 33 p refs
(NASA-TN-D-6923; L-7783) Avail: NTIS HC $3.00 CSCL 21B

This work was conducted to define further the effects of propellant composition variables on the acceleration-induced burning rate augmentation of solid propellants. The rate augmentation at a given acceleration was found to be a nonlinear inverse function of the reference burning rate and not controlled by binder or catalyst type at a given reference rate. A nonaluminized propellant and a low rate double-base propellant exhibited strong transient rate augmentation due to surface pitting resulting from the retention of hot particles on the propellant surface. Author

N73-10967*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF UNSTEADY THERMAL BOUNDARY LAYERS
Roy W. Miller Washington Nov. 1972 85 p refs
(NASA-TN-D-7054; E-6876) Avail: NTIS HC $3.00 CSCL 20M

The velocity and temperature distribution in an unsteady thermal boundary layer is analyzed by an approximate integral method. The case of a flat plate in a free stream having small harmonic velocity oscillations about a steady mean value is treated in detail. The resulting velocity profiles agree with the available experimental data. These profiles are used to predict the thermal convection when the plate and the stream are at constant but different temperature levels. The flow oscillations cause harmonic temperature oscillations plus a small steady feedback effect which reduces the mean heat transfer to the plate. The amount of decrease is represented by a single coefficient, which is presented graphically. Author

N73-10968*# Pittsburgh Univ., Pa.
SUBCOOLED FORCED CONVECTION BOILING OF TRICHLOROTRIFLUOROETHANE
R. S. Dougall and D. J. Panian Washington NASA Nov. 1972 21 p refs
(Grant NGL-39-011-079)
(NASA-CR-2137) Avail: NTIS HC $3.00 CSCL 20M

Experimental heat-transfer data were obtained for the forced-convection boiling of trichlorotrifluoroethane (R-113 or Freon-113) in vertical annular test section. The 97 data points obtained covered heat transfer by forced convection, local boiling, and fully-developed boiling. Correlating methods were obtained which accurately predicted the heat flux as a function of wall superheat (boiling curve) over the range of parameters studied. Author

N73-10969# Acurex Corp., Mountain View, Calif. Aerotherm Div.
AEROTHERM GRAPHITE SURFACE KINETICS COMPUTER PROGRAM. VOLUME 2: FORTRAN VARIABLES, FLOW CHARTS, AND PROGRAM LISTINGS
Jan. 1972 178 p refs
(Contract F04611-69-C-0081)
(AD-744854; Aerotherm-UM-72-25-Vol-2; AFRPL-TR-72-23-Vol-2) Avail: NTIS CSCL 20/13

A Fortran 4 computer code is described which computes thermochemical ablation rates of pyrolytic graphite surfaces, as a function of surface temperature and pressure, assuming all heterogeneous reactions at the surface are kinetically controlled. The calculation of the chemical state at the surface uses a film coefficient model which accounts for the unequal diffusion of species. All homogeneous reactions between gas-phase species adjacent to the surface are assumed to be in equilibrium. The specific surface reactions which are taken to be kinetically controlled include the reactions of condensed-phase carbon with water vapor, carbon dioxide, and hydrogen. Several options are available for computation of the boundary-layer edge state required in the diffusion model, including isentropic expansion or compres-

sion and normal or oblique shock wave calculation procedures.
Author (GRA)

N73-10970# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HEAT TRANSFER IN A REACTING POROUS BODY DURING FILTRATION OF A GAS
G. A. Fateev 10 Mar. 1972 21 p refs Transl. into ENGLISH from the book "Teploi Massoobmen pri Fazovykh i Khim. Prevrashcheniyakh' Minsr, 1968 p 100-113
(AD-745460; FTD-MT-24-1223-71) Avail: NTIS CSCL 21/2

On the basis of an earlier published analytical study of heat exchange the authors make an analysis of the mechanism of transfer for the case of exothermic interaction within a porous body between an oxidizer introduced with the gas flow, and a solid or gaseous reagent. The report examines the case where endothermic conversions take place below the zone of reaction along the path of the gas flow. The authors present graphs of the dependencies of the relationship of the heat transfer and reaction rates, and also of the relative maximum temperature in the porous medium. Author (GRA)

N73-10971# Purdue Univ., Lafayette, Ind. Project Squid Headquarters.
PHYSICAL MECHANISMS OF CARBON FORMATION IN FLAMES
B. L. Wersborg (MIT, Cambridge), J. B. Howard (MIT, Cambridge), and G. C. Williams (MIT, Cambridge) Jun. 1972 34 p refs Prepared in cooperation with MIT, Cambridge. Dept. of Chem. Eng.
(Contract N00014-67-A-0226-0005; NR Proj. 098-038; Proj. Squid)
(AD-744920; SQUID-TR-MIT-66-PU) Avail: NTIS CSCL 21/2

The size, size distribution, number concentration, and number charged of carbon particles down to about 15 A diameter in a flat acetylene-oxygen flame at 20 mm Hg were measured using a molecular beam sampling system combined with electrical deflection of the beam and electron microscope analysis of beam deposits. Coagulation of carbon particles occurs at all positions sampled in the flame. This process and surface growth form particle clusters that gradually change from roughly spherical at early and intermediate stages of growth to chainlike in the flame tail. The particle size distribution changes from Gaussian in the early stages of carbon formation to lognormal in the later stages. Particle number concentration and the rate of nucleation and coagulation each exhibit a maximum soon after the onset of carbon formation, but the rate of surface growth is maximum initially. The number fraction of charged particles is 10 to 40%. Author (GRA)

N73-10972# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE CRITICAL DENSITY OF HEAT FLOWS IN THE PRESENCE OF INTERNAL HEATING OF ANNULAR CHANNELS
V. I. Tolubinskii, A. K. Litoshenko, and V. L. Shevtsov 25 Feb. 1972 11 p refs Transl. into ENGLISH from Teplofiz. i Teplotekhn., Akad. Nauk Ukr. SSR, Inst. Tekhn. Teplofiz. (Kiev), no. 16, 1970 p 3-6
(AF Proj. 1426)
(AD-743681; FTD-MT-24-1165-71) Avail: NTIS CSCL 13/1

The article gives the results of an investigation of heat exchange crisis in the presence of internal heating of annular channels having a width of from 0.5 to 4.0 mm, under conditions of forced movement of underheated water. An analysis of the obtained experimental data is given. Author (GRA)

N73-10973# Naval Postgraduate School, Monterey, Calif. Dept. of Mechanical Engineering.
THE OPERATION OF ROTATING NONCAPILLARY HEAT PIPES M.S. Thesis
John Sanford Woodward Mar. 1972 60 p refs
(AD-743730) Avail: NTIS CSCL 13/1

A Nusselt-type analysis was performed for laminar film condensation on the inside of a truncated rotating cone, which included the interfacial shear between the vapor and condensate, the vapor pressure drop, the thermal resistance in the condenser wall, and the condenser exterior cooling mechanism. An approximation of this analysis made it possible to find a numerical solution for small half cone angles greater than zero. A parametric study was performed of this approximate solution for various fluids, RPMs, half cone angles, and exterior heat transfer coefficients. A non-capillary rotating heat pipe containing distilled water as the working fluid was tested. It was rotated at 700, 1400, 2100, and 2800 rpm, and heat transfer rates of the heat pipe were determined experimentally for different vapor saturation temperatures corresponding to electrical power inputs ranging from 1 kW to 7 kW. Author (GRA)

N73-10974# California Univ., Los Angeles. Dept. of Physics.
INVESTIGATION OF PERSISTENT CURRENT STATES IN ROTATING SUPERFLUID HELIUM CONTAINED IN SUPER-LEAK
Haruo Kojima Jun. 1972 173 p refs
(Contract N00014-69-A-0200-4014; NR Proj. 384-302)
(AD-745316; TR-35) Avail: NTIS CSCL 20/13

Fourth sound techniques were extensively developed into a powerful tool for investigating persistent current states in rotating superfluid helium contained in a superleak. Unique features of these techniques are: (1) persistent superfluid component velocity is directly determined by the Doppler-shifted splitting of a fourth sound resonant mode in an annular cavity; (2) the superfluid component density is determined simultaneously and independently by measuring the velocity of fourth sound; (3) persistent current states are observed from a rotating frame. The fourth sound techniques allows observations of persistent current states which are otherwise inaccessible in a stationary measurement. As a consequence the authors show that every phenomenon observed in rotating locked superfluid helium (Bose superfluid) has an analogous counterpart in an irreversible type-II superconductor (Fermi superfluid). Author (GRA)

N73-10975# Acurex Corp., Mountain View, Calif. Aerotherm Div.
AEROTHERM AXI-SYMMETRIC TRANSIENT HEATING AND MATERIAL ABLATION COMPUTER PROGRAM (ASTHMA3). VOLUME 2: FORTRAN VARIABLES, FLOW CHARTS, AND PROGRAM LISTINGS User's manuel
Jan. 1972 164 p refs
(Contract F04611-69-C-0081)
(AD-745441; Aerotherm-UM-72-26-Vol-2; AFRPL-TR-72-24-Vol-2) Avail: NTIS CSCL 11/2

The report presents definitions of Fortran variable names, flow charts, and listings for the Aerotherm Axi-Symmetric Transient Heating and Material Ablation Program, Version 3 (ASTHMA3). Author (GRA)

N73-10976# Pennsylvania Univ., Philadelphia. Towne School of Civil and Mechanical Engineering.
CONSERVATION AND BETTER UTILIZATION OF ELECTRIC POWER BY MEANS OF THERMAL ENERGY STORAGE AND SOLAR HEATING Interim Report, 1 Feb. - 1 Jul. 1971
Manfred Altman 1 Oct. 1971 265 p refs
(Grant NSF GI-27976)
(PB-210359; UPTES-71-1) Avail: NTIS HC $6.75 CSCL 13A

A project to investigate the application of heat and coolness storage for comfort heating and air conditioning was initiated. Inexpensive salt hydrates exhibiting phase change temperatures between 40 F and 60 F were found appropriate with use of off-peak generation of coolness for storage and subsequent use during peak demand periods to supplement or replace electrically powered air conditioning units. Other inexpensive salt hydrates, with phase change temperatures of 89 F to 195 F were found for use as heat storage materials with solar heat collectors and off-peak electric heating units. A feasibility demonstration of the off-peak air conditioning system was built and successfully tested. Author (GRA)

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N73-10977# Weizmann Inst. of Science, Rehovoth (Israel).
SCIENTIFIC ACTIVITIES, 1971
1971 448 p refs
Avail: NTIS HC $24.50

Brief summaries are presented of research projects and progress, and publications are listed. The areas of study include applied and pure mathematics; electronics and nuclear physics; chemical physics, chemistry, isotope research, and plastics research; biochemistry, biophysics, and polymer research; biodynamics, biological ultrastructure, cell biology, chemical immunology, experimental biology, and genetics; and science teaching and promotion of science among youth. Reports of the graduate school, computer service center, animal center, biological services, and the library are also given. N.E.N.

N73-10978# National Research Council of Canada, Ottawa (Ontario).
THE NAE MODEL OF THE HIGHWAY CABLE BARRIER FOR PARAMETRIC STUDIES OF VEHICLE REDIRECTION USING DIGITAL SIMULATION
H. F. L. Pinkney, G. L. Basso, and I. J. Fraser May 1972 73 p refs
(NRC-12694; MS-133) Avail: NTIS HC $5.75

The basis for experimental and analytical studies on the highway cable barrier is described and the analytical model of the cable barrier which was formulated and programmed for digital simulation is considered. The analysis contains a complete description of an erected curved barrier in terms of post locations, post strengths, cable elevations, cable length, cable modulus and cable pretension. The simulation follows, in time, the cable interaction on the sprung mass and the release of the deflected cables by fracturing of the posts. The condition of friction between the vehicle and cables and the constraint posts and cables is included in the analysis. This cable barrier model is processed as a building block subroutine of the BPR-CAL single vehicle accident simulation program. The data from five experiments with speeds up to 55 mph are used to provide an initial assessment of the cable barrier analysis and the simulated redirection of the vehicle. Author

N73-10979# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
EQUIPMENT FOR SPACE RESEARCH
1972 267 p refs In RUSSIAN
Avail: NTIS HC $15.50

Articles are presented which discuss various aspects and methods of space research. The development of space electronics, theoretical and practical problems of information transmission on distant space link channels, orientation of celestial objects and the determination of their coordinates, and questions of technically realizing apparatus for space studies are considered. Transl. by K.P.D.

N73-10980# Committee on Science and Astronautics (U. S. House).
BRIEFINGS BEFORE THE TASK FORCE ON ENERGY OF THE SUBCOMMITTEE ON SCIENCE, RESEARCH, AND DEVELOPMENT, VOLUME 2
Washington GPO Mar. 1972 185 p refs Briefings held in Oct. and Nov. 1971 presented to the Comm. on Sci. and Astronaut., 92d Congr., 2d Sess., 21 Mar. 1972
Avail: Subcomm. on Sci., Res., and Develop.

The hearings concerning the research and development requirements for future national energy needs are reported. The optimal application of technology for the conservation of minerals, and the enhancement of environmental resources are discussed invluding: (1) power siting methodology, (2) utilization and disposition of rejected heat, (3) emissions reduction and management, (4) resources exploration and development methodology, and (5) efficient use of energy. Fast breeder reactors, solar arrays, and coal gasification are discussed as energy sources. F.O.S.

N73-10981*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
JPL QUARTERLY TECHNICAL REVIEW, VOLUME 2, NO. 3
Oct. 1972 146 p refs
(Contract NAS7-100)
(NASA-CR-128329) Avail: NTIS HC $9.50 CSCL 05B

Summaries of research are presented that include the following: (1) development of a precision geodetic measurement system, (2) an algorithm for synthesizing mass and stiffness matrices from experimental vibration modes, (3) feasibility of using xenon-filled silicon germanium thermoelectric generators for outer planet exploration, (4) chemorheology of Viton B fluorocarbon elastomer, (5) extensional flow of bulk polymers subjected to a constant stress history, and (6) mission objectives and midcourse maneuvering strategies of Pioneer 10. For individual titles, see N73-10982 through N73-10987.

N73-10982* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A 3-D MULTILATERATION: A PRECISION GEODETIC MEASUREMENT SYSTEM c13
P. R. Escobal, H. F. Fliegel, R. M. Jaffe, P. M. Muller, K. M. Ong, and O. H. VonRoos *In its* JPL Quart. Tech. Rev., Vol. 2, No. 3 Oct. 1972 p 1-11 ref (For availability see N73-10981 01-34)
CSCL 08E

A system was designed with the capability of determining 1-cm accuracy station positions in three dimensions using pulsed laser earth satellite tracking stations coupled with strictly geometric data reduction. With this high accuracy, several crucial geodetic applications become possible, including earthquake hazards assessment, precision surveying, plate tectonics, and orbital determination. Author

N73-10983* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Engineering Mechanics Div.
AN ALGORITHM FOR SYNTHESIZING MASS AND STIFFNESS MATRICES FROM EXPERIMENTAL VIBRATION MODES c32
R. G. Ross, Jr. *In its* JPL Quart. Tech. Rev., Vol. 2, No. 3 Oct. 1972 p 12-21 refs (For availability see N73-10981 01-34)
CSCL 20K

An algorithm is described for synthesizing the mass and stiffness matrices from experimentally derived modal data in a way that preserves the physical significance of the individual mass and stiffness elements. The mass and stiffness matrices are derived for a rollup solar array example, and are then used to define the modal response of a modified array. Author

N73-10984* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Guidance and Control Div.
XENON FILLED SILICON GERMANIUM THERMOELECTRIC GENERATORS c03
F. DeWinter *In its* JPL Quart. Tech. Rev., Vol. 2, No. 3 Oct. 1972 p 22-31 refs (For availability see N73-10981 01-34)
CSCL 10B

An analysis is presented that shows the desirability and feasibility of using a xenon fill in the initial stages of operation of a silicon-germanium radioisotope thermoelectric generator to be used in outer-planetary exploration. The xenon cover gas offers protection against oxidation and against material sublimation, and allows the generator to deliver required power throughout the prelaunch and launch phases. The protective mechanisms afforded by the xenon cover gas and the mechanization of a xenon supply system are also discussed. Author

N73-10985* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Propulsion Div.
LONG TERM AGING OF ELASTOMERS: CHEMORHEOLOGY OF VITON B FLUOROCARBON ELASTOMER c06
S. H. Kalfayan, R. H. Silver, A. A. Mazzeo, and S. T. Lui *In its* JPL Quart. Tech. Rev., Vol. 2, No. 3 Oct. 1972 p 32-39 refs (For availability see N73-10981 01-34)
CSCL 07D

The continuation of a study to ascertain the nature, extent, and the rate of chemical changes that take place in certain selected elastomers is reported. Under discussion is Viton B, rzgarded as a temperature and fuel resistant fluorocarbon rubber. The kinetic analysis of the chemical stress relaxation, and infrared

and gel permeation chromatography analysis results are discussed.
Author

N73-10986* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Propulsion Div.
EXTENSIONAL FLOW OF BULK POLYMERS c18
T. J. Peng *In its* JPL Quart. Tech. Rev., Vol. 2, No. 3 Oct. 1972 p 40-45 refs (For availability see N73-10981 01-34)
CSCL 11D

A study was made of the behavior of polyisobutylene under motion at a constant stretch history for both strip biaxial extensional flow and simple extensional flow. Steady-state non-Newtonian viscosities were observed at various constant stretch histories. Newtonian viscosities for both strip biaxial and simple extensional flow were found to be in agreement with the classical theory. The results of the study provide an essential part of the experimental background necessary for the development of a new general stress-strain-time relation for uncrosslinked and lightly crosslinked polymers. Author

N73-10987* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Mission Analysis Div.
A SUMMARY OF THE PIONEER 10 MANEUVER STRATEGY c30
R. B. Frauenholz and J. E. Ball *In its* JPL Quart. Tech. Rev., Vol. 2, No. 3 Oct. 1972 p 46-61 refs (For availability see N73-10981 01-34)
CSCL 22C

The Pioneer Project placed a number of interesting and precise requirements on the navigation of the Pioneer 10 spacecraft flyby mission to Jupiter during 1972-1973. To satisfy these requirements the Pioneer navigation team employed a number of versatile computer programs to evaluate the strategies and maneuver sequences required to execute midcourse corrections. The Pioneer 10 mission objectives and the midcourse strategies used to satisfy these objectives are summarized. Author

N73-10988# Committee on Science and Astronautics (U. S. House).
ENERGY RESEARCH AND DEVELOPMENT
Washington GPO 1972 730 p refs Hearings before Comm. on Sci. and Astronaut., 92d Congr., 2d Sess., No. 24, 9-11, 23-25, and 30 May 1972
Avail: Subcomm. on Sci., Res. and Develop.

The Subcommittee on Science, Research and Development considers the formulation of a national energy policy facing an estimated fivefold increase in total energy consumption between now and the year 2000. Limited supplies of fossile fuels and hydroelectric power make it necessary to develop other sources of energy, namely, solar power and nuclear power. G.G.

N73-10989# Committee on Appropriations (U. S. House).
DEPARTMENT OF TRANSPORTATION AND RELATED AGENCIES APPROPRIATIONS FOR 1973. PART 3: DEPARTMENT OF TRANSPORTATION: FEDERAL AVIATION ADMINISTRATION, FEDERAL RAILROAD ADMINISTRATION, OFFICE OF THE SECRETARY; TESTIMONY OF MEMBERS OF CONGRESS AND OTHER INDIVIDUALS AND ORGANIZATIONS
Washington GPO 1972 1454 p refs Hearings before Comm. on Appropriations, 92d Congr., 2d Sess., 13-24 Apr. 1972
Avail: Subcommittee on Dept. of Transportation and Related Agencies Appropriations

Department of Transportation and related agencies appropriations for the fiscal year 1973 are considered. Budget estimates are presented for the Federal Aviation Administration, the Federal Railroad Adminstration, and the Office of the Secretary. G.G.

N73-10990*# Aerospace Corp., El Segundo, Calif. Air Transportation Group.
STUDY OF SHORT HAUL HIGH-DENSITY V/STOL TRANSPORTATION SYSTEMS, VOLUME 1 Interim Report
H. L. Solomon Jul. 1972 263 p refs
(Contract NAS2-6473)
(NASA-CR-114466; ATR-72(7301)-1-Vol-1) Avail: NTIS HC $15.25 CSCL 01C

The relative advantages of STOL aircraft concepts were examined by simulating the operations of a short haul high-density intercity STOL system set in two arenas, the California corridor and the Chicago-Detroit-Cleveland triangle, during the 1980 time period. The study was constrained to the use of three aircraft concepts designated as the deflected slipstream turboprop, externally blown flap, and augmentor wing turbofan configurations. The projected demographic, economic, travel demand, and travel characteristics of the representative arenas were identified. The STOL airline operating scenarios were then formulated and through the use of the aerospace modal split simulation program, the traveler modal choices involving alternative STOL concepts were estimated in the context of the total transportation environment for 1980. System combinations that presented the best potential for economic return and traveler acceptance were then identified for each STOL concept. Author

N73-10991*# Aerospace Corp., El Segundo, Calif. Air Transportation Group.
STUDY OF SHORT HAUL HIGH-DENSITY V/STOL TRANSPORTATION SYSTEMS. VOLUME 2: APPENDICES Interim Report
H. L. Solomon Jul. 1972 209 p refs
(Contract NAS2-6473)
(NASA-CR-114467; ATR-72(7301)-1-Vol-2-App) Avail: NTIS HC $12.50 CSCL 01C

Essential supporting data to the short haul transportation study are presented. The specific appendices are arena characteristics, aerospace transportation analysis computer program, economics, model calibration, STOLport siting and services path selection, STOL schedule definition, tabulated California corridor results, and tabulated Midwest arena results. N.E.N.

N73-10992*# Auburn Univ., Ala.
THE 1972 NASA-ASEE SUMMER FACULTY FELLOWSHIP RESEARCH PROGRAM Final Report
J. Fred OBrien, Jr., Donald C. Raney, and Marion I. Kent Sep. 1972 56 p refs Program, 9th Ann., held in Huntsville, Ala., 5 Jun. - 11 Aug. 1972; sponsored by the Am. Soc. for Eng. Educ. and NASA, Washington, D. C.
(Grant NGT-01-003-045)
(NASA-CR-61395) Avail: NTIS HC $5.00 CSCL 05I

The planning, administration, description, and evaluation of the MSFC/Auburn U/U of Alabama research program are briefly outlined. Abstracts of fellows' research activities are included. N.E.N.

N73-10994# European Space Research and Technology Center, Noordwijk (Netherlands).
THE PMC SYSTEM. PART 1: AN EXPLANATION FOR INITIATORS
31 Aug. 1970 17 p
(ESRO-PSS-02/PMC-01) Avail: NTIS HC $3.00

The PMC system is a management tool for monitoring the compilation and execution of the ESRO budget and program. A set of computer-printed reports are produced at monthly intervals, showing the actual situation compared with the plan. These reports assist in the process of revising the plan and reallocating finances to the best advantage. The operation of the system is outlined.
Author (ESRO)

N73-10995# European Space Research and Technology Center, Noordwijk (Netherlands).
THE PMC SYSTEM. PART 2: CONCEPTS AND APPLICATIONS
Oct. 1970 48 p
(ESRO-PSS-03/PMC-02-Pt-2) Avail: NTIS HC 4.50

The PMC system is a management tool for monitoring the compilation and execution of the ESRO budget and program. A set of computer-printed reports are produced at monthly intervals, showing the actual situation compared with the plan. These reports assist in the process of revising the plan and reallocating finances to the best advantage. The reports are discussed.
Author (ESRO)

N73-10996# European Space Research and Technology Center, Noordwijk (Netherlands).
PLANNING AND CONTROL FOR EUROPEAN SPACE SATELLITE PROJECTS. A SYSTEMS APPROACH TO PROJECT CONTROL AT ESTEC

Hellmuth Gehriger Paris ESRO Jul. 1972 109 p refs (ESRO-SP-70) Avail: NTIS HC $7.50

The practical application of modern project management and control techniques to meet the demands of an international organization operating on government funds and executing multimillion dollar projects of a highly complex nature are considered. The individual techniques are described of critical path network analysis, work package cost control and phased project planning have been integrated into a comprehensive project control system and successfully implemented and applied to the various satellite projects of the European Space Research Organisation. The contractual implementation of the system is emphasized, and particular consideration is given to the human factors, which are so crucial to the success of any system operation. With only slight modification, the project control system described here can be applied with equal success to projects in other fields. Author (ESRO)

N73-10997# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

BIBLIOGRAPHY, WITH ABSTRACTS, OF AFCRL PUBLICATIONS FROM 1 JANUARY TO 31 MARCH 1972

1 Apr. 1972 203 p refs

(AD-745168; AFCRL-72-0247; AFCRL-SR-140) Avail: NTIS CSCL 04/1

The bibliography lists all AFCRL in-house reports, journal articles, and contractor reports issued from 1 January to 31 March 1972. Abstracts are included. Author (GRA)

N73-10998# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

NUCLEAR WEAPONS

V. A. Mikhailov and I. A. Naumenko 28 Apr. 1972 67 p refs Transl. into ENGLISH from the monograph "Yadernaya Fizika i Yadernoe Oruzhie" Moscow, 1966 p 122-179

(AD-745857; FTD-MT-24-1271-71) Avail: NTIS CSCL 15/6

These chapters include discussions on the principles of a nuclear reaction, the different types of nuclear explosions which are used militarily (ground, underground, underwater, air, and space) and the effects of their striking factors (shock wave, light radiation, penetrating radiation, radioactive contamination) on men and objects, radiation sickness in man, and basic atomic defense means for military personnel and equipment in a combat area. Author (GRA)

N73-10999# Intermountain Forest and Range Experiment Station, Ogden, Utah.

AN INVENTORY DESIGN USING STAND EXAMINATIONS FOR PLANNING AND PROGRAMING TIMBER MANAGEMENT Final Research Paper, 1970-1971

Albert R. Stage May 1972 23 p refs

(PB-210276; FSRP-INT-126) Avail: NTIS CSCL 02F

Considerations guiding the despgn of a forest inventory for providing in place data for planning and programing timber management are discussed. The inventory procedure uses field examination of stands in sample subcompartments augmented by aerial photo interpretation of conditions in compartments and subcompartments not examined on the ground. The data are compiled to provide timber information that can be stratified with respect to land use zones, size of stand, accessibility, land stability, productivity, and by restrictions imposed by competing uses. Author (GRA)

N73-11000# Office of Naval Research, London (England). 06/6

EUROPEAN SCIENTIFIC NOTES, VOLUME 26, NO. 3

Seymour L. Hess and Victoria Hewitson 31 Mar. 1972 35 p refs

(AD-740761; ONR-26-3) Avail: NTIS

Contents: Aerospace; Biological sciences; Education; Engineering; Materials; Mathematics; Ocean sciences; Chemistry. GRA

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NEW NASA PUBLICATIONS

Experimental InterAmerican Meteorological Rocket Network (EXAMETNET): The First Five Years, 1966–1970 (NASA SP–293)

This document assesses the achievements of the first five years of EXAMETNET, a cooperative space effort of Argentina, Brazil, and the United States. The publication describes the formation of the network, international and national relations, technology, data procedures and techniques and their improvements, and the research that has been accomplished. *Paperbound.* 64 pp. For sale by the National Technical Information Service, Springfield, Va. 22151, for $3.00.

Remote Sensing of the Chesapeake Bay (NASA SP–294)

The proceedings of a conference sponsored under the combined auspices of the states of Delaware, Maryland, and Virginia, and the National Aeronautics and Space Administration for the purpose of identifying the primary environmental problems of the Chesapeake Bay area and determining the extent to which remote sensing can contribute to the solution of these problems. *Paperbound.* 190 pp. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $2.25.

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